Paving and Municipal Engineering

VOLUME IV. MARCH, EIGHTEEN NINETY-THREE. NUMBER 8.

MUNICIPAL EQUIPMENT AND ENGINEERING OF PARIS.*

III.

THE ADMINISTRATION OF PUBLIC WORKS.

THE transformation of the French capital from narrow streets, bad water and poor drainage, into modern Paris, with its handsome avenues, good water and complete drainage, is due to the plan of organization and the administration of its department of public works, more than to the financial resources of the city. Several other cities have had, and now have, greater financial strength; but because of the lack of a properly organized administration of public works, added to the fact that trained and able men are seldom selected and given permanent positions, such cities produce but few economical, homogeneous and lasting improvements.

The Americans insist upon a careful organization and a trained *personnel* in private enterprises of great magnitude. Shall we not insist upon an equal equipment for that most important of all enterprises, namely, the administration of a *city*, entrusted with the moral and material welfare of human beings.

Paris insists that the health and prosperity of its citizens depend more upon the department of public works than upon any one other branch of the city government. The appointment to positions in this department depends first upon the technical or other suitable education. Promotion is never lost sight of, and it depends upon seniority, coupled with technical and executive ability. The hope and possibility of promotion is the secret of success of much of the

*Copyright 1893 by J. W. Howard.

municipal work in European cities. Remove this hope and supply its place with political influence, and—we have too many examples of the results.

The magnitude of the improvements at Paris made since 1852 can be judged from the fact that upon the one work of opening new streets and avenues and widening old ones Paris has spent 1,202,000,000 francs ($240,400,000). One of the noblest and ablest engineers the world has ever seen was connected for forty years with these vast undertakings. At his death, two years ago, all Paris was in mourning. His name is Monsieur Jean C. A. Alphand. A brief outline of his life forms the best introduction I can present to the subject of the public works of Paris. Having reviewed the organization of this department, we can better study in subsequent articles the details of water-works, sewers, pavements, etc., each administered by a special division of the department. All are interlaced but not complicated with the other divisions. The co-operation of the different divisions conduces to better success. It has been my experience to see a lack of co-operation in some cities between the water, sewer and paving departments, resulting in wasted energy, time and money as well as poor results.

Monsieur Alphand at seventy-one years of age, when I last saw him, was erect, energetic, active and full of business. He was a privileged official, admired and loved by all. He had no enemies and his only opponents were a few members of the city council, opposing some of his proposed millions for improvements. Even these reproached him admiringly for working too hard and for having concentrated so many powers in one person.

Paris honors him for the plans which he drew up at thirty-six years of age in 1854 according to which the city has been reconstructed.

He is admired for his second plan for the enlargement of the city, as well as for executive work throughout the forty years of his public service.

The broad avenues cut directly through the blocks of houses, and the arrangement of the streets of the new sections are lasting monuments to M. Alphand and his able assistants.

All work executed at Paris during the last forty years was more or less planned, studied, prepared or directed by this remarkable

man, whose history is now being written in French, and remains to be undertaken in English.

His father was a colonel in the army of Napoleon I. He graduated from the *Ecole des Ponts et Chaussees*, the chief civil engineering school of France, and after working at railway construction and road building in central France, he became known for the construction of a difficult deep water quay. He also showed ability as an organizer of public celebrations.

When called to Paris, his first duty was in charge of public gardens, parks or promenades. He did well and became popular, for Parisians spend most of their leisure time, day or evening, out of doors. He laid out the grand suburban parks; the Bois de Boulogne in 1854–8, Park Moncean in 1861, Bois de Vincennes in 1861–4, Buttes-Chaumont in 1869–70 and Montsouris 1869–70.

He parked several boulevards, including the avenue of the Bois de Boulogne leading to the principal park of Paris, a popular drive, frequented by all visitors who desire to see *le grand monde* of Paris and their equipages. M. Alphand helped construct Boulevard Voltaire, cut through the dense masses of houses. He planned and reconstructed the Moncean quarter, where narrow, crooked streets, and darkness day and night, did much moral and material harm. Straight, broad streets admit air and light, and drive out much that injures property as well as persons.

All this cost millions, many millions. But M. Alphand spent his portions honestly and well. Never has he been even suspected of gaining more than honor, public thanks and his moderate salary. M. Alphand, notwithstanding his technical education, loved fine art, and often insisted upon expensive embellishments of fountains, statuary and paintings in connection with the streets, parks, bridges and buildings constructed by the city. These enormous expenditures for art in connection with practical public works make Paris far pleasanter for those living there. At the same time these and other attractive features of the productions of M. Alphand cause thousands of foreigners to choose Paris as their abiding place, having retired from the pursuit of gain in their own lands. These and the million visitors each year to Paris more than repay the interest on the loans required to accomplish these works.

It is pleasant to remark that our capital, Washington, with its fine buildings, pleasant squares and parks, and quiet, clean asphalt

streets, attracts many retired successful men to it, to live there and enjoy those things which many other cities have not the foresight to provide.

The prosperity of many a city ceases in proportion as it fails to retain its prosperous retired merchants and the income derived from their capital.

One of the noblest and best things which M. Alphand did was to always sustain and defend his trained and trusted assistants, from the highest engineer to the humblest clerk. His whole department therefore acted as a unit and was always true to its chief. All business was carefully classified and assigned to the proper division and that division held strictly responsible for the results.

After the commune of 1871 had blocked so many streets with paving stone and other barriers, as soon as peace was established, M. Alphand within a very few weeks made all the streets available for use.

In 1878 all the branches of public works were concentrated in his hands.

In 1878 he designed the garden of the Trocadero.

In 1889 he became the director of construction of the Exposition, continuing his duties as the head of the public works of the city.

M. Alphand avoided politics, as every city engineer should, and thus induced politics to let him alone. He declared that his politics were to make Paris agreeable, beautiful and healthful.

The department of public works, which he reorganized and managed so long, is now in excellent condition and well administered by his successor.

This is all the more possible because of the complete and well indexed records which M. Alphand, like other able engineers, insisted upon being kept for the benefit of his co-workers and successors.

The department of public works has charge of all construction within Paris, the water supply and the sewers and canals of Paris. It governs and inspects all private construction.

The employes are divided into two categories:

First. The bureau or indoor service, which keeps records of all correspondence, maps, plans, scientific and engineering statistics, estimates of costs.

Second. The executive, called the active or exterior service,

which plans, executes and inspects the works of the department. The highest official is the "Director of Public Works of Paris," next comes the sub-director, who is his deputy or vice-director; then comes a very important official, liked and admired by all. He is the private secretary of the director, modest and able. He suppresses his own name, but because of his splendid education and long experience he is of great value to the city. He does all in the name of the director. It was my pleasure to be his guest last summer. No man could have been more polite, attentive and aided another more than this estimable gentleman does those who are presented to him.

THE BUREAU SERVICE is organized as follows: The director is in general charge. The sub-director next. Both are aided by the private secretary of the director. We would call him chief clerk of the department of works. Then come four divisions.

FIRST DIVISION subdivided into *Bureau No. 1*, for general matters and questions concerning the employes of the service. *Bureau No. 2*, recording the matters of the water supply, canals and sewers.

SECOND DIVISION embraces the public thoroughfares by all upon or along them. It has *Bureau No. 1*, for the acquisition of property by purchase, by agreement, or process of condemnation. *Bureau No. 2*, establishment of building lines, etc., sanitary construction of buildings. *Bureau No. 3*, pavements, etc., roadways, sidewalks, and lighting of the streets.

THIRD DIVISION concerns architecture. The sub-director acts as chief of this division, in addition to his general duties. He has also many other special duties, such as the collection of the plans and models of the whole department; direction of the municipal observatory; inspection of the Paris telephone service; inspection of the pneumatic clocks, and compressed air power companies. The Third Division has three Bureaus. *Bureau No. 1*, concerns the architectural works of the municipality proper. *Bureau No. 2*, architectural works done on account of France or the Department of the Seine, but within the limits of Paris. *Bureau No. 3*, for public architectural accounts and examinations, and permits of all proposed public and private buildings and other visible constructions.

FOURTH DIVISION—Fine Arts of Historical Work. *Bureau No.*

1, for the record and supervision of all fine art enterprises of Paris, including instruction, competitions, exhibitions, public celebrations, preservation of the works of art in the gardens, streets and buildings. *Bureau No. 2*, cares for the works of writings concerning the history of Paris, encouraging new discoveries and writings upon that subject.

The bureau service constantly calls in the engineers of the active or exterior service for information and consultation.

The Council of Engineers, presided over by the chief mayor (prefect) of Paris, or, in his absence, by the director of public works, meets once a week. All important proposed improvements, especially those requiring the co-operation of several divisions of the active service are there considered. This council is one of the ablest engineering bodies in the world. It is composed of heads of divisions and others as follows: The prefect and his general secretary, the director, a consulting engineer, the chief engineers of the streets and parks, the chief engineer of the department of the Seine, the chief engineer of the city quarries, the chief engineer of the water-works and sewers. An able assistant engineer is the secretary of this council. Other engineers of all grades can attend these meetings to listen or speak, as the public service may warrant. These latter, however, do not vote. But they certainly are much encouraged by the fact that they are recognized, and at times asked to describe the projects they have in hand, or are about to undertake. This council of engineers belongs rather to the constructing branch, which I will now outline.

The active or exterior service is the branch which plans and executes public work. It is also under the director and sub-director. There are six divisions:

Division A—Public thoroughfares and promenades. It is divided into *Section 1*, for city maps and the study of where extensions or widening of old streets and the establishment of new streets are needed. *Section 2* has, first, a sub-section which decides upon and executes in detail alterations and widening of old streets and cutting through or construction of new streets. Secondly, a sub-section for building permits and inspection, numbering of houses and naming of streets. Thirdly, a sub-section of sanitary engineers, who devise means and methods of sanitary equipment and

cleanliness of all portions of private and public property, establishing the sanitary regulations of Paris. *Section 3*, supervision of public vehicles of all kinds, including horse-cars, omnibuses, public carriages, drays, etc. *Section 4*, paths, trees, flowers, etc., of the squares, promenades, parked avenues and parks. *Section 5*, pavements of roadways and sidewalks of the city and its parks, street cleaning and lighting, temporary or permanent use of portions of the sidewalks and roadways. The subject of pavements is so important that the city is divided into two equal sections, and a chief engineer of the highest grade put in charge of each. They are aided by two sets of assistant engineers, who attend to details. *Section 6*, inspection of gas, gas meters and electric lighting.

Division B—Water Supply. *Section 1*, care of municipal canals, care of sources of water supply. *Section 2*, maintenance of aqueducts to the city. *Section 3*, distribution of water. *Section 4*, maintenance of machinery.

Division C—Sewers. *Section 1*, house sewerage. *Section 2*, construction and cleaning of sewers. *Section 3*, irrigation of farm lands with sewage.

Division D—Administering and mapping the quarries under the city, supervising foundations of buildings. It is interesting to know that a little more than 10 per cent. of Paris is undermined by these quarries of building stone.

MAJ. J. W. HOWARD, B. L., C. E.

See biographical sketch in January number, 1893, page 6.

Division E—Architecture. *Section* 1, administration and inspection. *Section 2*, construction and maintenance of the municipal buildings, schools, markets, abbatoirs, cemeteries, etc.; also the inspection and approval of certain classes of private buildings.

Division F—Of fine arts and historical productions and discoveries concerning Paris.

This finishes the outline of the organization of one of the most efficient engineering departments the world has ever seen. When properly studied it suggests many valuable thoughts to every student of political science. Judged by its fruits it is well worth our attention.

J. W. Howard.

NOTES ON SEWAGE AND SEWERS.

THE disposal of sewage has called for a display of the highest grade of engineering skill. The thickly populated countries of the old world have found it necessary to refrain from polluting the streams. With this object in view, various plans have been devised, looking to the disposal of sewage matter; viz.: mechanical and chemical precipitation, filtration and irrigation. There are various mechanical devices in practical use, having in view mechanical precipitation. First. Flat basins filled with sewage and allowed to stand until precipitation is complete. This plan involves different sets of tanks, so that they may be intermittently filled and discharged. Second. Long basins through which the sewage flows slowly. Any of the basins may be cut out for cleaning, but the motion is constant. This plan is designated as continuous precipitation. Third. Upright tanks through which the sewage rises slowly.

The sludge or settlings is not always removed after each precipitation. It may be allowed to accumulate. The arrangement of the settling chambers and the devices employed for cleaning them are various, ingenious and extensive, and there are many of them, which, combined with the chemical plan of precipitation, have worked very successfully. The sludge is generally removed when it is sufficiently wet to admit of its being drawn out through suction pipes.

Lime and sulphate of alumina are used both separately and together as agents of chemical precipitation. Other materials are occasionaly used in combination. The mixing is done by either passing the entire body through a pipe, or by means of a flutter wheel; occasionally the chemicals are forced through a perforated pipe. The amount of precipitates to be used depends on the character of the sewage. That, of course, is dependent upon the judgment of those in charge. The separation of solid material from sewage by filtration is a well understood process. The operation of filtering is necessarily intermittent. Filtering material may be of sand, sod, earth, brick, quarry spalls or other porous material. Straw, grass and other similar substances are sometimes used. The work of filtration must be intermittent for the reason that it is desirable that the air pass through the separated material from time to

time. The plans of arrangement are so ingenious and complete, that detailed descriptions can not be given here. Under all these plans it is contemplated that the material removed be used as fertilizer.

Irrigation with sewage seeks to make direct use of the fertilizing material on what is known as sewer farms. The plans of operation vary in detail, though the general idea is the same. It is intended to intermittently discharge the matter over the surface of the field, and to then under-drain the soil so that the water may be drawn off and run into the streams after having passed through a section of the soil. Thus we have the principle of filtration, and aeration used to separate the organic material, and to purify the water which is discharged. One feature which would prevent the general use of the irrigating system in our own country, would be the relatively small demand for fertilizing material, and the large areas required to be covered. A city like New York or Boston would require an area of sewage farms quite as large as the city itself. Until arrangements can be made to run sewers well into the country, and to discharge the material over large areas, it need not be expected that this plan would be generally successful in this part of the world. The large rainfalls which come to us would also be in the way of its adoption. The plan having one system of sewers for storm water and another for house drains, would admit of greatly simplifying the question of the disposal of sewage.

* * *

A new system of sewer construction has come into use during recent years in France and Germany. It is known as the Monier system. It is intended to do away with the use of brick, stone or other similar material. A thin wall and surrounding of concrete, filled in with wire and light metal are used in lieu thereof. The excavation is made in the usual manner, then a frame work of heavy wire is constructed so that the meshes are from two to four inches in diameter To this is fitted the concrete coating, which is put on in the form of a wall entirely surrounding the mesh, and of a thickness varying from two to four inches. It might be suggested that this construction is not strong; but when we remember that railroad bridges of long spans are now being constructed on the same principle, that roofs for warehouses, factories and other important

structures are being constructed according to the Monier system, we may rest quietly on this score. The first use to which the Monier system of construction was put was in building sewers. Its great strength immediately suggested the construction of bridges, roofs and other work of that character.

Monier culverts for country roads are now being made according to the above plan. That is, a wire frame work is formed spanning the stream or ditch below it; one inch from the under side of the wire is placed a form made of inch boards. The wire is blocked so that it can not approach the form or board center under it by an inch. On top of this is placed the cement concrete, in a way to surround the wire and come some few inches above it. The abutments and foundations of the culvert are made of the same material, and the hole is filled with road-making material to the proper level, to conform to the general contour of the road itself.

The first use of this Monier principle in architectual work was for glass factories. Monier, the inventor of this system, was a Frenchman. His patents were taken out some years ago and have now about expired.

* * *

In many of the cities of Europe the sewers occupy a very distinct relation to street cleaning. It is the custom in Paris to brush all of the refuse on the street into the gutters, turn on the water and drive it into the sewers. This is a part of the street cleaning operation. One will notice in time of snow that the street sweepers come out in force and sweep all the snow possible into the gutters, turn on the water and wash it into the sewers. As soon as the sun appears and there is a little thaw the ice and all of the refuse matter, which is a part of it, is immediately treated in the same way. In the matter of cleaning the streets one need not imagine that any very large volume of material is washed into the sewers. It is an every day operation. On the street in which the writer lived during eleven months of his stay in Paris three street sweepers could be seen every morning between eight and half-past eight, marching in line up one side of the street and down the other. This cleaned a wide street. After they had passed over it the water was turned on from the water works, which were designed particularly for street

cleaning. For a few minutes only it would show unclean in the gutters; after this the stream of water would be as clear as a mountain stream. The water used for this purpose in Paris, it may be known, is pumped directly from the Seine. The drinking water is a separate and distinct system. It comes from lakes thirty or forty miles distant. However, it is no uncommon sight in Paris, after the water has been running a few minutes in the gutters, to see housekeepers take their buckets, go to the outside, and with dippers fill them with water. In truth, no one feels any great anxiety about its cleanliness. When one can see the yellow sand washing over the stones in the gutter and notice its perfect cleanliness he feels fully assured as to its character. When streets are cleaned every day or every two or three days there is really very little impure material to be washed away. If one leaves a street for a year or two years without cleaning, or if a community does the same thing, the flushing of the gutters from the water works is altogether a very serious operation. The adjustment of the grades on the Paris streets is so nice that when those who have charge of the flushing of the gutters desire to change the direction of the flow of the water they merely throw down a piece of jute, which forms a dam. On the relatively level streets this changes the direction of the flow. This indicates not only nice street cleaning, but at the same time fine engineering. A piece of jute sacking may not form a dam more than two inches high, yet it is sufficient to change the direction of the current from a gutter flushing hydrant, and thus aid the street cleaning.

* * *

In many sections of the United States the question of the disposal of sewage is quite different from what one finds it either in Great Britain or England. While there are more days of rain in either of these countries than with us, on the other hand we have very heavy rains, which are not known to the sections named. Even through the northern parts of the United States rain-falls of a semi-tropical character are not uncommon. Therefore, a plant having to do with the disposal of sewage, either on the irrigating, filtering or precipitation plan would be found unsatisfactory. A rainy season in France is practically without heavy rains. It may rain every

day for weeks and months, yet the rain is never heavy and no one is ever seriously inconvenienced by it. In the United States we may have several days of dry weather followed by one or two days of heavy rain-fall which, under ordinary arrangements having to do with the disposal of sewage, brings about a very embarrassing condition. A plant arranged either for sewer irrigation, filtration or precipitation in England, Germany or France, would oftentimes be found utterly inadequate for an American city of smaller population and area. It would appear from the above statement that a plan having to do with the disposal of the sewage of cities in America would be more successful were the house drainage separated from the general street drainage.

The house drainage would be measurably uniform; while, of course, the street and rain-fall drainage would be influenced altogether by climatic conditions. Our country is too new and the evils of the pollution of streams are, at this time, not sufficiently pronounced, or, to be exact, not sufficiently to bring about a serious consideration of this problem. If one considers the question closely he will find, however, that few or none of the large cities of America are provided with pure drinking water, and that its impurity is largely owing to the discharge of sewage material into the source of drinking water supply. While this question is not altogether a live one at this time, it is sure so to be within a few months all over this country. Those who are practically interested in water supply realize this state of affairs and when they are addressed by those not liable to give them trouble, they uniformly acknowledge the true condition of things, which is that few or none of the water companies of the large cities and towns are fully satisfied with the character of their water supply. This is true, owing to the discharge of sewage material into the sources of drinking water supply.

LOUIS H. GIBSON.
See biographical sketch in January number, 1893, page 15.

Louis H. Gibson.

ROAD ENGINEERING EXTRAORDINARY.

THE most unique road engineering project in which the writer was ever engaged was while in Europe, surveying off the North British coasts. An engineer proposed throwing a road across the narrowest part of the channel separating Britain from Ireland, which, between Cantire in Scotland and Tor point on the Hibernian coast, is little over a dozen miles. The specification was for a national highway of the uniform width of 100 yards, to have two roads, a double railway track, and two foot paths for passengers. Like all big undertakings, this project has now been in abeyance for years. Every now and then it crops up, and will, I suppose, one day be constructed. For the edification of engineers in other countries who may ever have this kind of work in view, some notes on the scheme will be useful. I will reproduce a few of the inventive engineer's remarks contained in a brochure, and leave an opinion to be formed by the reader:

The water which divides Great Britain from Ireland is all that exists to maintain the actuality of a divided nation.

Link the two islands by an isthmus, and one realm becomes a fact. Only 14½ miles of water divide the two countries at Cantire, a distance so insignificant in the estimation of engineers that a bar could be erected easily and expeditiously to join the islands forever, the bar serving for free transit from shore to shore, and excluding the inflow of the mighty gulf stream which now floods the Irish sea, loughs, and shores of the eastern coasts of Ireland and western shores of Scotland, England and Wales.

The ship-way for the vessels from the north Atlantic to the Irish sea could be by two canals of short lengths at Cambeltown and Tarbert, through the peninsula of Cantire, in addition to the existing one at Crinan into the Clyde. The effect of diverting the gulf stream from the Irish sea would, it is estimated, cause the subsidence of the Irish sea, so as to lay bare 1,000,000 acres of land now covered by shallow water on the shores and loughs, and favor naturally land drainage near the coasts.

By contrast with a similar undertaking, the reclamation of the Zuyder Zee by a dyke twenty-five miles long (now in progress in Holland), it has many advantages. In my proposal for joining

Great Britain and Ireland, the distance is ten and a-half miles less than the Holland dyke now in progress, and the stone and earth for the isthmus are close on the spot, ready for gravitation from the Mounts of Genmakeram (1,300 feet high), Carnlea (1,200 feet), Clady (1,000 feet), Escort (980 feet), also from Dees Point at Cantire. In Holland the materials have to be brought from a distance.

The whole subject has been stated succinctly in two editions of a pamphlet on and entitled "The Land Junction of Great Britain and Ireland," published about 1880–82 (by Templeman brothers, 36 Great Portland street, London), with charts of the proposed bar to form a high causeway from land to land, and of the currents of the inflow of the gulf stream, marked shaving six knots an hour. The greatest depth is 400 feet. The sub-stratum of the sea bottom is of shells, stone and rock—an admirable base for a superstructure which the genius of the present age might create to mark an epoch of modern science, conjoined to patriotism.

For six months the present writer was engaged in observations of all the bearings of this notable scheme, and it is deemed worthy of the equal consideration of those who have the welfare of England in mind. As a national work carried out at public cost, so as to insure a free way for the united island, I estimate the cost at between two and three millions of pounds, if convict labor were used, and the time required to effect the junction and cut two short canals, about two or three years. *J. C. King.*

Mr. John Charles King is an Englishman, London born, country bred, with a wide range of experience in his profession—a surveyor and engineer—acquired by travel and important managerial positions, in which road-making, drainage and forestry were leading features.

His love of hard work in land improvement, building, farming, etc., seems to have left him ample leisure in the midst of his work for literary pursuits—for contributions of various scientific papers for English, French and American journals, and for the lighter effusions of fancy in verse and lyric pieces. "A Hundred Songs From the Saddle" (some written on horseback during the waits at cover-side, mainly), attest his versatile genius.

Naturally, amongst his writing, road-making, highway law and drainage are fittingly explanatory of his experience of fourteen years on the highways as surveyor, and of his inventions of a simple road-bonding tram-rail, non-slipping horse-shoes, horizontal balance of body of two-wheeled vehicles on steep hills, three-wheeled omnibus (trail-wheel behind), cylindrical carts for road or rail, for

dust, or refuse, and numberless minor inventions in agricultural implements and machinery. In cultivation of crops his system of interlining doubles the yield. Of course, his prime aim is the unification of the British kingdom by his large idea—which he, however, thinks but a small enterprise practically, as it is a work of gravitation and cementation of materials. It has won encomiums for its originality and comprehensiveness from all the statesmen of England for the past fifteen years. But politics are a sensitive trade-cult, and "The Tom Fiddler's Ground" that his isthmus would obliterate, would spoil the "greedy gain" now made by both parties that play the game of politics in England.

He is the projector of *The Road*, a riding and driving journal, issued from time to time by the firm of King & Co., 50 Booksellers' Row, London, of which he is now the head.

ORIGINAL RESPONSIBILITY OF CITY CIVIL ENGINEERS.

THROUGH the agitation of the press the community at large are becoming awakened to the demands for the physical improvement of our cities, towns, and villages.

An investigation of these demands reveals the fact that a great portion of them arise from a want of a sufficient or proper plan of original improvement, which now necessitates a reconstruction at a considerable if not not complete loss of the original improvement.

Such things justly provoke the tax-payer who is now called upon to bear the burden and bear the consequences of errors that should have been avoided. Frequently, these errors have been made from want of advice and direction by a competent engineer. More often they have been made because of the "penny-wise and pound foolish" policy so largely pervading smaller city and town governments.

Many engineers, who have had their plans subject to such a policy, are to-day endeavoring to escape the criticism, now shifted upon them by these economists, by saying, "I told you so," but their excuse is not readily accepted and probably they deserve part of the "roasting" they are getting.

Professor McNally, the Chicago phrenologist, says an engineer requires a large development of the perceptives so as to see the future requirements of an undertaking, and also well developed tact to continue and have adopted plans tending to that end. Herein common sense and the science agree.

No engineer should engage upon an undertaking without giving it a thorough investigation with all its surroundings. No mat-

ter how small the undertaking there will be local and modifying influences to be considered and dealt with. At this point the engineer may employ his perceptive faculties in apprehending what future requirements may possibly be, although present indications may not point to them as even probabilities.

While he must of necessity be a practical man, ever ready to meet and deal with emergencies, he must have a broad enough mind to live like a Blaine, a generation ahead of his associates.

It is the duty of every professional man to keep a pace ahead of his fellow-man in knowledge and thought of matters pertaining to his chosen profession, and we have a right to expect of him that he shall see the end from the beginning and be in a sense an educator of public opinion in his line, especially in impressing upon those by whom he is employed the necessity of following his directions. For instance, an engineer who is associated with a district to be improved for residence, should observe what the natural features and conditions thereof are and study how to further aid nature in supplying details that will conform to the general plan usually so wisely laid before us. He should be willing, by conversation and contributions to the local press, to call attention to the necessity of starting in on developments in a proper manner. He can roughly diagram how drainage basins should be associated, streets laid out, parks and public grounds reserved, etc.

Too many engineers act as though they think their skill is only to be employed in battling down and destroying what nature has placed, as though they were obstacles in his way.

People of artistic taste in home surroundings welcome the surveyor possessing enough art and originality to break away from the old stereotyped form of rectangular platting and provide them with something true to nature and breaking the monotony of sameness. Some general form must be observed to provide convenience and conform to leading thoroughfares, as the special cases may require. While the opportunity is thus at hand to follow and develop what nature has provided, a proper system of sewerage and drainage can be easily inauguarated. These are matters almost invariably deferred until after street construction, when they properly should precede them.

In the January number of PAVING AND MUNICIPAL ENGINEER-

ING, Mr. J. W. See, of Hamilton, O., makes the assertion that sewers "have nothing whatever to do with the question of streets." I should like to change his expression by saying streets should have nothing to do with sewers. So far as my observation and study has led me I favor the removal of sewers from streets to alleys, which should be more commodious than they are usually platted. But to say that sewers should have no part with street drainage is rather a broad assertion which will bear much study and should be determined for each special town or district. Whatever the disposal of street drainage may be, the first grade made should be such as will meet all future requirements. Let no false economy be practiced upon the grade.

Mr. See, in the article before referred to, makes an excellent point on the importance of bringing a street to a proper gradient by cutting rather than by filling. It is seldom advisable to make a fill of any great length in front of property that is not too low for drainage.

The portion of grass plot or tree space and of planting should early be arranged for. Trees are usually planted too close to the sidewalks, and in later years their roots, which so eagerly seek the sand bedding of the pavement, will be sure to break and derange the best stone, concrete or brick pavement.

Having collected all required data, a course of study and investigation of the best practice upon the proposed improvement should be made. The investigation should not stop with the reading of one man's ideas, the report of one method employed in a similar case, or the visiting of the nearest work of the same class, but the collection of facts and data from good authority holding different views and employing different practice. These will aid you in your deliberations to decide upon a method to pursue.

There are engineers ever ready to furnish officials "standard" printed plans and specifications so finely prepared as to fit all cases —like a patent medicine—and about as reliable.

It is in the display of an understanding how to manage the varying conditions of the case that makes an engineer valuable and appreciated. He should be original but not an experimenter or given to the introduction of new schemes for their novelty. Having matured the plans another obstacle is frequently met in having them

sanctioned by a higher authority. It is surprising to notice how many men think they possess a correct idea of how any piece of public work should be executed.

Another evil sometimes encountered is one of the legal profession, who imagines he must prepare the specifications in connection with the contract. Possibly he has an old class-mate, now a practicing engineer in another state, who sent him specifications which he had prepared for similar work there. If such be the case, he should be admitted with the patent medicine man.

These are grievances rather than responsibilities too well known to the engineer to bear enlarging on here. Any objections raised should be patiently heard, considered and accepted for what they are worth. Valuable suggestions and thoughts often come from a very unexpected source.

Engineers, as a class, are rather sensitive regarding their pet theories, and have a dread of admitting an error of judgment or practice; but they should be willing to receive advice and make modifications if good attend it. In case of doubt or disagreement, consult a brother member of the profession.

This point, in conclusion, I would like to impress: Do not lower your professional or personal dignity by permitting your plans and operations to be altered or modified so as to divert the intention for which they were projected, or bring discredit upon your work. Do not let the man who is so narrow-minded or selfish as to be willing to "let the future take care of itself" influence you. Neither be discouraged because the majority may not be in your favor, for more than once the whole world has been wrong and one man right. Do not be stubborn, but be firm. Better sacrifice the few dollars you expected to earn and respectfully decline a position where you can not exercise your judgment, than for the policy of pleasing a few lay yourself and your ennobling profession subject to everlasting censure of those who will follow and suffer.

Frank Knight.

AN INSTANCE OF VILLAGE IMPROVEMENT.

In the spring of 1881, J. H. Bromwell, Mayor of Wyoming, Ohio, in his annual message, called the attention of the village council to the good work that had been done by the Village Improvement Society and urged the necessity of having a general survey made of the village, that an intelligent system of grades might be established and public improvements made upon a uniform system. The recommendations of the mayor were adopted by council and I was engaged to make a topographical survey of the village in order that sufficient data might be obtained for carrying out further improvement. Upon the completion of this preliminary work, the village council immediately commenced the actual work of improvement, which has been carried forward from the spring of 1882 to the present time on the plans recommended. The total length of streets in the village in 1882 was 61,334 lineal feet; in 1892, 70,334 lineal feet. Since 1882, 50,032 lineal feet of streets have been improved at a cost of $22,500. Prior to 1888 Wyoming had but little to boast of in the way of sidewalks, but in that year she became one of the pioneers in the new sidewalk crusade, and the following statement shows what has been done in this very important part of public work since then:

CEMENT SIDEWALKS LAID IN WYOMING.

1888....	5,985	lineal feet	$5,936 02
1889 ...	3,450	"	1,336 47
1890....	2,274	"	1,546 50
1891....	415	"	321 62
1892....49,133		"	41,844 88
	61,257	"	$50,985 49

The total length of single walks laid in cement being eleven and three-fifth miles.

In 1888 the question of issuing bonds to the amount of $15,000 for sewerage was favorably voted upon and a commission was appointed to submit a general plan for the sewerage of the village. Under the direction of this plan and the sewerage committee of

council there has been expended for sewerage purposes the sum of $12,350.

The total amount expended for public improvements during this period has therefore been as follows:

For street improvements	$22,500 00
For sidewalks	50,985 49
For sewerage	12,350 00
Total	$85,835 49
Add amount paid for school buildings including new High School property	35,000 00
Total	$120,835 49

The above amount while representing the amount actually paid by the village government does not, however, represent all that has been expended for public improvements and there should be added $25,000 each for amusement hall and electric light plant, making a total of $170.835.49.

As the last item of public improvements we would call attention to the new water-works, just finished at a cost of $35,000. The plant consists of a fine pumping station, containing first-class boilers, three deep well pumps, and one large force pump; also there are six and one-half miles of pipe and a reservoir with a capacity of 3,000,000 gallons.

There are two boilers set in one battery but bricked so that they can be run either together or separately. They have a combined capacity of 150 horse-power. They are made of the finest grade of flanged steel, three-eighths of an inch thick, and are capable of carrying a working pressure of 150 pounds.

The source of water supply is derived from driven wells each eight inches in diameter. One of them is 159 feet deep, one 146 feet, another 140 feet and another 130 feet. At present, however, only three of these wells are being used.

The reservoirs being 3,000,000 gallons capacity and situated 230 feet vertical height above the pump-house, give a pressure of very nearly 100 pounds to the square inch. The 10-inch pipe leading down from the reservoir, distributing the water through the village is about one mile long and will deliver at the lower end 2,188 gallons of water per minute and will supply eight $1\frac{1}{8}$-inch smooth

nozzle fire streams, and with 100 feet of rubber-lined 2½-inch hose, each nozzle will throw a fire stream to a vertical height of 146 feet, or a horizontal distance of 186 feet.

As to whether these improvements have paid for themselves or not, we find a conclusive answer in the affirmative by comparing the valuation of property in 1882 with that in 1892. In 1882 the tax valuation was $500,000. In 1892 the tax valuation was $1,200,000. *E. F. Layman.*

E. F. Layman was born in Cincinnati in 1835, educated in the public schools, studied mechanical engineering in the office of Frank Millward, and civil engineering in the office of R. L. Read. He was head draughtsman at a number of the large factories before beginning the practice of civil engineering. He was assistant engineer on the Indianapolis Belt railway in 1873 and was in charge of surveys for the Cincinnati depot grounds on the Cincinnati Southern railway in 1875 and 1876. Since then he has been engineer of the village of Wyoming, Ohio, since 1881, and has had charge of the construction of its water-works and other public improvements. He is also engineer for five other villages in Hamilton county, besides having a large private pratice.

MAINTENANCE OF ROADS IN FRANCE.

III.

From the method of maintaining a macadamized road, as I have described it in my last two articles, one might conclude that the filling of the depressions in the road can not equal the amount of stuff taken away, and consequently the thickness of the macadam must continually decrease; this is very true; in fact, if it was found convenient or necessary to lower the elevation at some given places, it would be quite possible to so direct the cleaning as to let the wagons wear off the whole surface uniformly or nearly so, but, on the other hand, if the engineer thinks the macadam is getting too thin, it is an easy matter to raise the surface.

From experience, we know that soon after the operation of spreading new material, as indicated in my last article, there appear new depressions that will ordinarily disappear under the action of cleaning and traffic; then, if we want to raise the surface, we may repeat our process of spreading stone by patches exactly as we

did at first, and repeat the operation as long as the weather permits, or as long as it is needed.

It will be seen by that, that the "cantonnier" can use about as much or as little new stone as he pleases, or as the engineer orders him to use, and yet keep his section in good shape.

On a well regulated road there must be an amount of new material spread yearly on its surface equal in weight to the amount of stuff, mud or dust, that has been raked or swept off; but that material need not to be exclusively clean stone, because a solid roadbed contains, besides stone, a certain amount of pulverized stuff that fills the interstices; the fact is, that if a portion of a road has lost, say 100 cubic yards of stuff, 60 cubic yards of clean stone would about replenish it, and as a consequence there would be no harm if some dried mud was mixed with the new stone in refilling. It would sooner get packed together and it would not be so rough on the wagons. It is easy to see, then, that a judicious use of mud might be quite an item in maintaining a road-bed, both in economy and convenience to travel.

From what I have said it will be seen that maintenance of roads consists of two operations—removing the mud and dust, and spreading of new material. The first operation requires constant attention, while the second requires constant attention, good judgment and some experience.

This method of refilling by patches can not be exclusively employed. In cities, for instance, the surface is allowed to wear down uniformly, and, when needed, general refillings are made, covering the whole road, which is then sprinkled and rolled as soon as possible. But here I am speaking especially of roads through the country where the patching method is mostly used.

It will be seen that such method requires, as a whole, constant attention, and the best way to get that is to divide the road into sections to be under the charge of one man. The length of such a section ought to be such that the "cantonnier" is kept busy the whole year round, yet able to keep it in good order. He gets used to his section and knows the bad places where particular care is needed. The length of those sections can not be given here even approximately. It depends on the amount of traffic, on the succession of seasons, on the quality of stone, etc. In France,

where travel may be estimated at probably five to ten times what it would be here, sections are from one-half of a mile to one mile.

Experience has proven that roads wear off in summer just as much as in winter. Of course this does not apply to northern climates where snow covers and protects them for months every year; yet as the proper time for spreading new stone is in the spring of the year, it is often found advisable to give the "cantonnier" some extra help to enable him to get through with that most important part of his work in proper time. For instance, in some countries or in some years the winter will hold on until the spring is too short and but few repairs can be done. Then it will be necessary to rush for a while and stop during the summer season, to start again in the autumn, if the weather permits.

There will be plenty of work for the "cantonnier" during the summer. He has to repair the ditches, to keep the road-bed in shape, to attend to the trees, and get the material ready for the next season. I will speak of those extra works afterwards, and while we are speaking of maintaining the macadam, and before we get through with it, I will add that in spite of all the vigilance of the engineer, through some extraordinary rainy season, or through the carelessness of some "cantonnier," some parts of a road may get so badly out of repair that they will need extra precaution and extra work to reclaim them before they are totally ruined.

ARTHUR LAGRON, C. E.
See biographical sketch in January number, 1893, page 17.

Next month I propose to tell how repairs are made. *Arthur Lagron.*

PAVING BRICK; THEIR MANUFACTURE AND USE.

[At the recent meeting of the National Brick Manufacturers' Association, in Louisville, Ky., the following paper on "Paving Brick; Their Manufacture and Use," was read by Mr. W. S. Williams, of Canton, Ohio:]

The clay should contain the proper amount of silica, aluminum

and iron, with the necessary amount of alkalies to thoroughly flux it. The silica, aluminum and iron are practically non-volatile, and will receive a high degree of heat without injury.

The clay must be tempered or pugged not with so much water as to produce a hydraulic resistance in compressing it, but with just a little water, just enough to induce a molecular change in the clay; it should be compressed to its utmost density, so as to assist nature as much as possible in forming a compact mass. In drying, the clay will creep together and shrink until the particles touch each other and then stop.

The rest of the water must be taken off at a red heat, when more shrinking takes place. The brick at this stage is ready to become a semi-molten mass, and if properly treated, when done, the product should be a dense homogeneous mass, from center to exterior.

Vitrified, so to speak, throughout, not in structure or series of structures, but a dense, compact mass, they should be so treated as not to become crystalline, or of a vitreous nature, but tough or annealed as it were, so as to have the greatest cohesive strength possible. This gives us a material with greater strength than any now known. In a crushing test, as shown by our testing laboratories, the vitrified brick proves to be about one-third stronger than granite.

Trautwine, who is regarded as authority by all civil engineers, assumes the weight of ordinary brick work as 112 pounds per cubic foot, and that it would crush under thirty tons per square foot; then a vertical column of it, 600 feet in height, would crush at its base under its own weight, and average granites that weigh 165 pounds per cubic foot would sustain a vertical column of 8,145 feet before crushing at its own base. Hence, as vitrified brick stand over one-third more under a crushing strain than granite, the brick vertical column will be over ten thousand feet in height before crushing at its base, under its own weight. Trautwine gives the average crushing strength of granite at six hundred tons per square foot, and from the best information we can get, our testing laboratories give the average crushing strength of good vitrified brick as over nine hundred tons per square foot.

Vitrified brick are comparatively new to our architects, and their value is as yet almost unknown to them, but in the near fut-

ure this brick must, of necessity, take a very important place with them, when they once thoroughly understand that they take no dampness and are stronger and more durable than granite.

In our larger cities where the air is tunneled with fifteen and twenty-story buildings, the width and strength of walls is a very important matter. Space can be economized in thickness of the walls by reason of great strength of the brick. In case it is necessary, they may be buttressed either exterior or interior, or both, and thus more room secured in the structure.

In a vitrified brick building, there should be a brick used in the interior of the building made of the proper proportions of clay and sawdust or its equivalent. This brick should be burned until it is thoroughly vitrified, the sawdust being consumed in burning, the brick left honey-combed, or full of air cells as it were. This brick should be carried up with the masonry as an inside lining of the walls in the interior of the structure; no furring, no lath required, plastering can be applied directly on the walls. The cellar should be paved with vitrified brick, and no brick allowed in the entire structure that is not vitrified.

This would give us a structure, the walls of which would have great strength, fire-proof, practically a non-conductor of heat and cold by reason of the air cells in the inside course of brick, walls perfectly dry, as they would not absorb a particle of moisture from turret to the bottom of the foundation, a fact which can not be said of any other known building material; and with this end in view it is absolutely requisite that we make the very best vitrified brick; that quality and not quantity should be the end to accomplish. The people of this country are now investing their money in permanent improvements, and they demand the very best material that can be produced.

The paving of streets, and roadways, has for a long time been a source of much anxiety to the engineer. Granite, expensive, noisy and eventually slippery and becomes as rough as coble-stone pavement. Asphaltum, costly, slippery and does not wear well. Macadam grinds up and forms a paste when wet, and is carried off by the wheel in the shape of mud, when dry it blows away, and is lasting and wears well only when there are one or two feet of snow upon it. Wood is not lasting and is a great absorbent, consequently unhealthy.

Vitrified brick, however, has taken a great load from the engineer's mind. It is durable, comparatively noiseless, inexpensive and easily repaired.

In the vitrified brick, treated as heretofore spoken of, we have the combined silica, aluminum, and iron; the resultant product gives us a material that is harder than steel and of cohesive strength, a material that will not be affected by the iron or steel tires of wagons.

No, the calks and toes of the horseshoe, the twelve chisels on the shoes of each horse, are undoubtedly the greatest enemy paved streets have to contend with. The ingenius blacksmith may change from iron shoes to steel and keep these chisels in excellent repair, yet this steel must give way to the vitrified brick. This is the first paving material yet found that would resist the horse's shoe. When the brick are manufactured as heretofore described, there is no way of calculating the life of a brick pavement, as there seems to be nothing that can wear it. The brick are hard, and yet do not become slippery, the draft horse always securing a good foothold.

In vitrified brick, the civil engineer will find just what he has been looking for, in permanent structures, such as arches, tunnels, sub-structures of all kinds, conduits, and especially in sewers. If he is constructing a sewer where there is much grade, he will find a material that will withstand the rasping and filing of all the sand and gravel that will pass though; it being vitrified it is non-absorbent. Acids and noxious gases, will not affect them, and find no place there. In a sanitary point of view, this fact the engineer dares not overlook.

Vitrified brick have come to stay, and have been staying on the face of the earth for a long time. By the rivers of Babylon and Ninevah we find that there have been unearthed glazed brick, and brick enameled. In the great brick city of Babylon, Babylon the city of brick, occupying in extent five times more than the present site of London, environed by a wall of brick, three hundred feet in height and eighty-five feet in width, we find that the hanging gardens were sustained by brick arches, brick laid in bitumen the equivalent of our combined coal, tar and ashphalt, the bed of the river paved with brick, and in their temples brick, vitrified to azure hue, after being placed in position in the structure. Stamped in the brick, their first system of writing is given us, viz., the cuneiform. On

what were once the banks of the Euphrates and Tigris rivers we find handed down to us the history of thousands of years ago. It tells us of the deluge, when the face of the earth was covered with waters. It informs us of the first great kingdom after the subsidence of the waters. We have stamped upon brick the name of one of their first great rulers, viz., Nimrod, the mighty hunter before the Lord. This history was not handed down to us written upon the columns of stone, nor monuments of brass. Such material seems to have succumbed to the action of the ages. But it is given to us on clay tablets. Simply brick, and nothing more.

[In the general discussion on the paper, remarks were made as follows:]

Mr. Adams: Mr. Williams has given us a very comprehensive paper. It is a revelation to many of us. We have been advised of the fact that brick when well made and properly dried and burned and laid, is the coming pavement for this country. And I want to impress this fact upon this convention. Nothing can stop the progress of brick for durable, lasting street pavements but the brickmakers themselves, by making an inferior article. It is with the brickmaker and upon him alone that depends the future of this great industry. In our city we have several miles of brick pavements, and we have one street, I am glad to say, it has only one square laid with brick, that the pavement is wearing out after one season of ordinary travel. We do the brick paving industry a great injury when we turn out anything but a good brick.

Joseph Stafford, Springfield, Ill.: I have left the past behind me and from now on am going to live in the future. In my judgment it is not a question of paving brick for street pavements, but how to get the proper clays and how to make them tough. I am here to say that I believe the clays that are right among the shales is the best for making paving brick. This may seem a little strange, but I believe in telling the truth as it appears to me. It is not a question of selling brick for street pavement, but a question of how to make them.

W. A. Rieman, Vincennes, Ind.: I can heartily agree with what Brother Adams said about the quality of paving brick made throughout the country. I know from personal observation that many who are claiming to make paving brick are not doing

anything of the kind. I visited a yard sometime ago where they are turning out a large number of these so-called paving brick; they are made in a very inferior manner and do not answer at all the description of a paving brick. I asked the manufacturer why he turned out that class of brick, and he said: "Oh, they are all right; they look all right, and we can sell them." Gentlemen, a brick of that kind has a tendency to discourage the use of paving brick, and it is illustrated in the city of our honorable president as well as in several other cities.

Mr. Rieman read extracts from a report of a special committee of the board of public improvements, of St. Louis, who visited Philadelphia, Washington, D. C., Wheeling, W. Va., Chicago, Cincinnati, Columbus and Newark, for the purpose of examining the brick pavements. The committee concluded that it was not advisable at present to recommend the use of brick as a paving material for streets.

D. V. Purington: I want to say that brick paving has probably never received a more severe blow than from the article just read, and which was printed in the papers throughout the country. I have no doubt but that the report of the committee was, to a great extent, true, and while I do not want to get up a discussion as to the clays in the different parts of the country, I want to say that in every town mentioned in that report the paving brick were made of clay largely of a fire-clay nature and not of shale. If the committee from St. Louis had desired to make a fair report as to the paving brick throughout the country, they should have visited some of the cities where shale clay brick were used, and not selected all where fire-clay brick were used. Mr. Adams struck the key-note of the situation. We should be more careful in the selections in the matter of paving brick than of building brick. If a brick is a little off color, in laying up a wall, you can lay it in the center and it will not appear in the face of the wall, and it will not hurt the wall, or the man who puts up the building, or the one who makes the brick. But in paving a street, every single individual brick is exposed, and a half-dozen soft brick will ruin the reputation of the brick-maker and the man who lays the street, and I want to impress it upon the minds of the men who make paving brick, that there is no part of their work so important as the sorting of their brick.

In the first place, Washington has not a single street paved its

entire length with brick of any kind or character. I myself visited Washington to investigate the conditions, and I found that the board of commerce had ordered a brick pavement laid in front of their building. And the man who laid the street laid brick for a length of about 150 to 250 feet on one side of the street, and on the opposite side of the street they had laid 150 feet with asphalt and 100 feet with granite blocks and the other 50 feet with wooden blocks; that proves that part of the report in regard to Washington false. In regard to Columbus, the statement in regard to the number of miles is absolutely false. It looks as though these reports had been prepared in the interest of the asphalt companies. Now Mr. Adams has given you a sermon in a few words, you gentlemen who are manufacturing paving brick, and all who are contemplating the manufacture of paving brick. You must have thoroughly prepared product and a thoroughly burned product; and, gentlemen, you must not put anything else on the market. I say if you follow that rule it will not be a question as to what kind of paving to use, but it will be a question of getting the brick.

Mr. Eudaly: I want to say a word about Columbus. We have a State Association in Ohio, and at one of our conventions a gentleman came in, and, when the subject of brick pavements was being discussed, told us that there was a street in Columbus where they had paved part of the street, several blocks, I think, with brick, and the other half with stone, and had allowed the pavements to lie for a certain length of time, and had finally taken up the stone and laid down brick. This happened in the very city of Columbus named in the report. As has been said before, the brick pavement is the pavement of the future, and there is no question about it. It is simply a question of making good brick. Let us look at it from a business stand-point. The man who has the best paving brick, the best building brick, or the best of any kind of clay ware, is the man who is going to sell it, so long as he is in the business. There is no question but that brick is better than asphalt and stone, and the people are finding it out, and brick are going down in the streets and roadways of this country, and there is no help for it. Every pavement that is put down makes it more sure, and the manufacturer who starts early to make brick that are good is the man who is going to make the money.

D. P. Guise: I read an article in the *Public Ledger*, of Phila-

delphia, very favorable to brick pavements, and about the same time there was an article published in the *Times* condemning brick pavements, and I said to myself, there is a "nigger in the woodpile" somewhere. Brick manufacturers are aware that the asphalt companies are doing all in their power to oppose the brick pavements. Last year, I do not remember just what time, a gentleman came to me and said, if you will make your paving brick three inches thick, five inches wide and twelve inches in length I will take your entire product. He said we want to meet a competition on the part of the asphalt companies, and gave as an argument that large size brick were more salable, consequently he wanted a large size brick. I spoke of this thing to show what opposition we are working against.

E. R. Harper, Akron, O.: About ten years ago the question of street paving came up in the city of Akron. For two or three years it was a fight between the asphalt people and the stone people and the brick people, but we finally succeeded in getting brick pavements down on the streets, and I am proud to say that since then we have no pavement of any other description, and you will never see anything but brick laid in the streets of Akron. In the matter of brick pavements the manufacturers must always keep quality in mind. One mistake paving brick manufacturers make and have been making is, they say to property owners and members of council and parties about to bid for a pavement, "I can furnish it to you so much cheaper than any other pavement," and then you are compelled to put your brick upon no foundation at all, comparatively. You go to the council and say, "I am going to put the brick in on a sand foundation," and you put your brick upon a sand foundation and enter into competition with an asphalt company that has put their pavement down on a hard rock foundation, and I say you are making a mistake. No board of improvement should be led to believe that it is going to cost much less to put down a brick pavement than any other pavement. Nine years ago after the discussion that had followed my urging the use of brick pavements, a committee was appointed, and they made a tour of cities that had brick pavements—Wheeling, Bellaire and several other cities—and they came back with a report that settled the brick question in Akron for that time, because those people had laid the

brick down on a sand foundation, and the result was the committee found there worn out pavements; the brick were not injured, but they did not stop to consider that, they simply said the brick are not good. You ought to educate your engineer that brick ought to have a good foundation upon which they can rest and rest all the time. So far as the brick are concerned, they are all right, but you must have a good solid foundation. [Applause.]

Frank B. McAvoy: I want to say a few words in regard to street pavements in Philadelphia. We have thirty-five miles of streets paved with brick, and with few exceptions where the brick put down were put down right the streets are in first-class condition, and the majority of the members of the city council are of the opinion that it is a good pavement, and would like to see more put down. The teamsters like it, they say it is easier on the horses, and prefer it to any other pavement. So far as our council is concerned, you can have anything you want in our city if you are willing to pay for it. Last year there was put down in Philadelphia 10,000,000 brick, and, in the future, brick will be laid in Philadelphia. We are slow in some things, but we are doing the fair thing in the way of pavements of brick.

Mr. Adams: I would like to say to my friend from Akron, that the brick street to which I referred in the city of Indianapolis, and which is now practically worthless, was laid on a concrete stone foundation of the very best character.

On motion of Mr. C. S. Ettla, of Clearfield, Penn., it was decided that the standard size of brick for paving purposes be the same as a standard size for building brick, that is, 8¼ x4x3¼.

THE SEWERAGE OF MEDINA, NEW YORK.

The village of Medina, New York, is the location of the celebrated sandstone quarries. The corporation is about two miles square, and contains five thousand people. It is divided into four parts by the Erie canal, extending east and west, and by the Oak Orchard creek, which runs from south to north. The surface slopes to the north and toward the creek. The creek, north of the canal, runs in a deep gorge. The rock lies quite near the surface, and

renders it necessary to exercise great care in designing sewers so as to have them deep enough to answer the purpose, and not to entail unnecessary expense by going too deep in rock cutting. There were in the village two or three stone drains, with rubble walls, laid dry, and covered with flagging. These, in course of time, were made to do duty as sewers, instead of being restricted to their legitimate use as drains, and with the usual results. A large part of the village had no drainage at all, except on to the surface of the ground.

For a long time efforts have been made to get sewers built for the relief of some particular locality, but without success. In 1889 the legislature passed an act authorizing incorporated villages to appoint boards of sewer commissioners. There are five of these commissioners, and they serve for five years without pay. They are not to be all of the same political party; one goes out each year. By a little management the board of trustees of the village of Medina was induced to appoint sewer commissioners under the act of 1889. The sewer commission is authorized to expend not to exceed one thousand dollars for sewer plans for the village. These plans must be submitted to the state board of health for their approval before they become effective. The state board of health sends an expert sanitary engineer to look the ground over with the plans in hand. Their action is based on his report.

If the taxpayers so decide, the whole system may be put in at once and the village bonded. Otherwise, on a proper petition of the property owners on any street, the sewer commission has power to lay a sewer in that street, if they deem it proper. By an amendment of the sewer act the streets which have a continuous line of sewers are to be taken for sewer purposes as one street. This enables people at the upper end of a line of sewers to get an outlet when those at the lower end are all opposed to it.

Under this law the sewer commission of Medina employed the writer to make plans for the sewerage of Medina. These plans were duly approved by the state board of health, and in April, 1891, the first sewer was constructed on West street. It is about a half mile long. Other petitions have since been presented, and two and one-third miles additional of sewers have been built. I will now describe the method of preparing the plans:

Center street runs through the village from east to west, entirely

across the corporation. West street runs from the corporation line on the south to the canal on the north. By running a transit line through these two streets they could be platted, and nearly all the other streets platted from them by measurement, without the taking of angles. The levels were run through the centers of the streets and alleys, care being taken to note accurately the street intersections. The party consists of a leveler, two tapemen using a steel tape, and a rodman. The hind tapeman notes the street intersections. Buildings with low foundations or extra deep cellars are made note of. Angles in streets between intersections are measured.

After the map is made, the contour lines are drawn, the location of the main outlet is decided upon, and the study of the location and grades and sizes of the sewers begins, the nearness of the rock being kept constantly in mind. After the depths were determined the grades were fixed, care being taken to keep the top of small sewers discharging into larger ones level with the top of the larger ones, or a little higher where possible. The sizes of the sewers which do not take surface water were then calculated by Weisbach's formula, and the storm water sewers by the formula proposed by J. W. Adams. Although Weisbach's formula is much used in sewer calculations, it does not strictly apply. The formula supposes that the water enters at one end of a pipe and discharges at the other, while in a sewer the liquid enters the whole length of it. There is also the matter of minimum grades. Writers on sewer construction give lists of grades to secure a given velocity, on the supposition that the pipe runs half full, while the truth is that the upper ends of small sewers have only a very small stream drizzling through them, with much less than the theoretical velocity due to the given grade.

The writer's greatest tribulations have been in the rebuilding of old drains. They are annoying from the sewage found in them, and the constant discharges from house drains, and also from demands of lot owners who have usually small dry stone drains connecting their cellars with the old sewer. They insist that these stone drains be connected with the new sewer. They get in the trenches, in the way of the workmen, and stand and measure and argue as to the proper pieces of pipe they need to make the connection. If their house drain is choked with earth, and you miss it and do not leave a Y branch exactly opposite to it, then the flood-

gates of wrath are opened wide. My experience teaches me to avoid the rebuilding of old drains.

The following is a list of the lengths, sizes, depths and percentage of rock in sewers:

Length.	Size.	Depth.	Per cent rock.
788	24 inches.	7 feet.	0.0
462	18 "	6 "	0.0
1,094	15 "	7 "	5.0
485	12 "	8 "	5.0
1,354	10 "	8 "	15.0
6,615	8 "	7½ "	
728	6 "	6½ "	8.0

The contract was let for a lump sum of $11,500, or about one dollar a foot. There are three Y branches to each 100 feet of sewer. There are eighteen lampholes and sixteen manholes. The manholes are built of stone taken from the trenches and covered with a cast iron cover. The lampholes are made of vertical pipe, covered with a cast iron cover. The present prospects are that the contractors will make a reasonable profit.

I have written this paper to call attention to the provisions of the New York sewer act, and also to the method of making sewer maps by co-ordinates, using two long streets at right angles, or nearly so, as co-ordinate axes. *O. C. Gillett.*

CURRENT INFORMATION.

MUNICIPAL MATTERS AT THE NATIONAL CAPITAL.

The recent cold spell created considerable activity in municipal matters in Washington, and it is predicted that a great reform will grow out of that frigid period to somewhat compensate for the many annoyances and inconveniences put up with by citizens here.

The cold weather seemed to affect nearly every department of municipal work. The quality of the gas produced a good deal of profanity. The freezing of water pipes was equally productive of a loss of religion, and consequent to this were fines imposed for wasting water, upon householders who preferred to let the water run, than to patronize the opulent plumber, and last, but not least, the garbage contractors and street sweeping contractors, came in for their share of vigorous criticism.

The quality of the gas during the cold spell was notably so inferior that it has led to no end of comment, and it is very likely that it will become the subject of congressional inquiry; in fact, Senator McMillan, chairman of the district committee, has already been authorized to investigate as to whether there is ground for the complaint which has been made, with regard to not only the quality of the gas used in the city of Washington, but the price paid for it. Senator Spooner and others held a lengthy inquiry into these matters some time ago, but no report was ever made to the Senate, nor was action taken. The inquiry into the matter is now to be taken up with the question left off, and an attempt will be made to secure a report at this session.

The Washington Gas Company, on the other hand, declare that the gas is better to-day than ever before. The gas company's inspector of lamps says that the complaints as to faulty street illuminations ought not to be laid to the quality of gas. The same trouble, freezing in the service pipes, has worried the people of other cities, and is worrying some of them still. He thinks that his company has succeeded admirably, and he can only find nine lamps out of 5,600 on which to base a complaint. During two weeks of the extreme cold weather, the gas company used fifty gallons of alcohol daily in cutting out the frost from street lamps.

It is now proposed that penalties be imposed upon the gas company for defective municipal lighting during the recent cold weather, and the committee will give the Washington and Georgetown Gas Light Company a hearing respecting this matter.

Another piece of legislation, which has been hurried by recent cold weather, was the passage by the Senate of the bill providing for the removal of snow and ice from the sidewalks and gutters of the city by the owner or tenants of each house or other buildings or ground within the first four hours of daylight, after every fall of snow. It must be removed entirely, under

penalty of $1.00 for each lot, for every such neglect. If the sidewalks are covered with ice, they must be strewn with ashes, sand, sawdust, or some other substance which will insure the safety of pedestrians. If the owner or tenant fail to remove snow or other obstructions from the sidewalks, the commissioners are empowered to have it done, and assess the cost as a tax against the property.

It is stated that during the past thirty days more than 1,700 permits have been issued by the District of Columbia, for opening streets to repair water-pipes that have frozen and burst. It is claimed by some that the latter result is due to the negligence of the water department in not requiring such pipes to be "laid at a depth of not less than thirty-six inches below the established grade," as the law requires. It is estimated that not less than $100,000 have been expended in repairing frozen pipes. Each citizen, in order to obtain a permit to open a street for repairing a leaky pipe, is required to pay a charge of $1, which tax has created a good deal of vociferous dissatisfaction, and the water department has come in for considerable censure. It is argued that instead of profiting by past experience, this department continues to allow these broken pipes to be relaid just as they were before, to be frozen again the first cold snap. In this connection the manner in which the south approaches to the Aqueduct Bridge were constructed and re-constructed by an army engineer, after they had washed away, was recalled. These approaches, which are some 400 feet in length, are constructed with paved cobble-stone gutters on each side, between the carriage-way and a plank foot-walk. As first constructed no provision was made for carrying off the water during a flood or heavy shower. The result was that during the great flood of June 2, 1889, the gutters and footwalks washed away, plowing a great gully hole down fifty foot embankment to the river and low ground below.

Instead of profiting by this experience, the engineer in charge of the bridge rebuilt these approaches exactly as they were before, to be washed away again by a thunder shower just one month after the June flood. They were then constructed properly as they should have been at first, with a great mid-grade at the gutter, and chutes each side of the gutter to carry the water down the embankment.

One gentleman said the other day that it is no exaggeration to say that more than $3,000,000 has been squandered during the past ten years, on public works in the District of Columbia, by army engineers. One item consisted of $2,570,279.39, which was buried by army engineers in a four-mile tunnel, abandoned as worthless.

A. I. P.

Washington, Feb. 18, 1893.

OPINIONS AS TO THE MERITS OF PAVEMENTS.

In a paper on the subject of street paving read before the Engineers' Club, of Kansas City, recently, Mr. John Donnelly, city engineer, referring to opinions as to the best kinds of pavement, said:

"Macadam will last as long as you repair and take care of it. Cedar blocks on concrete will continue in fair condition for five years and with some attention and sprinkling and repair it may an-

swer for service for four years longer. Cedar blocks on boards will last about four to seven years, when it gets beyond repair and must be renewed. Cypress blocks, about three years; the material appears to rot and becomes very bad a short time after being laid. Colorado sandstone, under heavy traffic, about five to ten years, at which time, if relaid, using some new blocks, it will last an equal period. Granite blocks will ordinarily need relaying in fifteen years, but is the only kind that will endure heavy city traffic.

"Brick, if of the right kind, will endure under ordinary traffic about ten years; on narrow streets under heavy traffic, it can hardly last that long. Of the durability of asphalt, I am not as well prepared to speak. The city of Washington, among the first to pave with asphalt, is still using streets paved more than fifteen years ago; although portions of it have been patched and repaired, no general reconstruction of the streets has been made. Our neighboring city of Omaha has pavements in fair condition after ten years of wear, and while seamed and cracked from shrinking of the wearing surface, are apparently good roadways and can yet be cleaned fairly by a street sweeper, and are as good for general travel as when first laid down.

"In conclusion, the paving question is not settled, and quite likely never will be. The city of Paris removes asphalt to put down wood; the city of London removes granite to replace it with asphalt; the city of New York covers her granite or trap (basalt) blocks with a sheet of asphalt to deaden the noise, and Chicago and St. Louis keep on putting down granite blocks, as if there was no other suitable material on earth, and the more noise you have the better. A number of interior cities, from Columbus, Ohio, to Lincoln, Nebraska, use brick and think there is no better material to be had, and in those cities fortunate to have parks and boulevards such highways paved with macadam and gravel are the best and safest driveways on earth. Finally, we will try to pave and repave our streets with material the choice of the men who pay for it, and trust they may become educated to know what is best."

INDIANA ENGINEERING SOCIETY.

The annual session of the Indiana Engineering Society in the office of the city engineer of South Bend was well attended, and there were a number of papers of more than ordinary merit presented. Frank Hodgman, of Michigan, gave a detailed and very graphic description of his work as locating engineer for some Rio Grande lines in the mountains of Utah. Some of the most difficult problems encountered by railroad engineers were detailed in an interesting manner. Wm. Whitten read an article on Heterodoxical Methods in Sewer Construction, which drew out considerable discussion because it was not in accord with the established order of things (as is indicated by its title). Mr. Whitten has the courage of his convictions, however, and is putting his ideas into brick and mortar. A paper by M. A. Howe entitled Diagrams of the Velocity and Discharge of Water Flowing in Circular and Egg-shaped Conduits, called out a discussion or debate on the reliability of the generally accepted formulas for the flow of

water. Other papers of more or less merit were read by members. There is one characteristic of this year's work which distinguishes it from that of former years, and that is a tendency to a more exhaustive consideration of special subjects rather than an attempt to cover the entire field of civil engineering. Legislation was let severely alone. An impression has obtained a foothold in some quarters that the society is an organization for the purpose of increasing the work and fees of county surveyors and city engineers, but there is no ground for the belief, as is shown by the fact that in the new constitution of the society the Committee on Legislation does not appear in the list of standing committees. Since the remarkable exhibition of animosity toward civil engineers displayed at the recent road congress, those men who are engaged on public works throughout the state have seen, as they never saw before, the absolute futility of attempting to convince the public by argument and reasoning that all civil engineers and all civil engineering are not to be measured by the standard of the local surveyor and his work. Possibly at some time in the future the public will recognize the value of special knowledge in municipal work as it now recognizes it in medicine or in law.

Some changes were made in the constitution which will no doubt be effective in widening the influence of the society. Five years of active practice is made the minimum for members, but a credit of three years is given on account of a professional diploma from a reputable engineering or technical school. Other changes of importance, which can not be detailed here, were made. W. M. Whitten was chosen President; C. G. H. Goss, Vice-President, and W. P. Carmichael, Secretary. The plan of the next meeting has not been decided upon.

REQUIREMENTS AS TO WIDTH OF TIRES.

A tire ordinance has been passed by the city councils of Philadelphia, applying especially to omnibuses. It regulates the license as follows: For an omnibus with its passengers which does not weigh more than 4,000 pounds, $75; if the weight be between 4,000 and 5,500 pounds, $100; between 5,500 and 7,000 pounds, $150; over 7,000 pounds, $200; and no license shall issue for an omnibus which shall, when loaded, exceed 11,000 pounds. The ordinance provides that all omnibuses running on streets paved with asphaltum shall be provided with flat tires of width as follows: For vehicles between 4,000 and 5,000 pounds, 2½ inches; between 5,000 and 6,000 pounds, 3 inches; between 6,000 and 7,000 pounds, 3½ inches; and for omnibuses weighing, loaded, 7,000 pounds and upward, 4 inches. The penalty for the violation of this provision is a fine of $100 for each and every offense. The ordinance is meant to apply only to omnibuses running regularly and continuously over the streets of the city.

SOME RECENT INVENTIONS.

A Street Sweeper. 490,188. Jacob Edson, assigned to Edson Manufacturing Company, Boston, Mass. This invention comprises a frame and rearwardly projecting brush-supporting arms secured thereto, a driving-shaft bearing provided with tubular extensions, and a truss secured to the frame and to the tubular extensions of the driving-shaft

bearing whereby the brush is supported and adjusted.

A Sewer Well and Grate. 490,301. Countcil Munson, Utica, N. Y. This invention comprises a circular sewer well and a curb section having a vertical grated curb face, spanning the circle of the well and curb section of a form whereby a portion of the top of the well is exposed and a part is covered by the section, the curb section being rotatable on and independent of the well, to enable the curb face of the curb section to conform to the curb line of the street without reference to the well.

A Furnace for Burning Garbage. 490,582. William McClave, Scranton, P. This invention comprises a furnace, a central stack mounted on its top and constructed with a circular combustion chamber in its base and concentric with the stack, a plurality of lateral combustion chambers in communication with the circular combustion chamber, and a system of passages and channel-ways for supplying heated air to facilitate combustion and also passages inclosed by suitable reservoirs or tubes for the introduction of the offensive substances into the furnace to be burned.

A Wood Water-pipe. 490,892. Melford D. Arms, San Diego, Cal. This invention comprises a wood pipe constructed of suitable staves having beveled edges, and formed exteriorly with circumferential grooves, in combination with a continuous covering of wood veneerings secured to the pipe by a cement coating, and a spring band or clasp surrounding the pipe within the grooves.

A Sprinkling Machine. 490,900. Walter A. Collins, Tullytown, Pa. This invention comprises a revoluble truncated cone-shaped casting, an axis, a water-deflecting disk secured to the casing at or near the discharge end disposed at a substantially right angle to the line of the axis, a water-nozzle discharging within the casing and means for revolving the casing.

A Pipe Coupling. 491,299. Axtel S. Vogt, Altoona, Pa.

Cement. 491,280. Bernard Dreyfuss, New York, N. Y., assignor to Rosa Dreyfuss. This invention comprises pulverized spent lime, pulverized carbon, silica, oxide of iron, alumina, lime and magnesia; and slacked rock-lime and sand.

A Safety Gate for Drawbridges. 491,177. Adolph Hoeffler and Frank L. G. Chapman, Stevens Point, Wis. This invention comprises a pivoted drawbridge and a flexible safety wound upon a shaft and adapted to be closed by the bridge, a locking device to hold the gate closed, a releasing device attached to the bridge and adapted to trip the locking device in whichever direction the bridge may be turned in closing the draw, and an automatically operating winding-up device permanently connected with the gate.

A Road Scraper. 491,565. James F. Kimball, Tilden, Maine, assignor to the Western Wheeled Scraper Company, Aurora, Ill. This invention comprises a carriage having a front steering axle, a suspended scraper blade, a shaft geared to and driven by the front steering axle, and a lifting mechanism geared with the shaft and connected with the scraper blade for lifting the latter by the rotation of the front steering axle.

An Apparatus for Cleaning Sewage, etc. 491,796. William Birch, Manchester, Eng. This invention comprises a series of settling tanks or compartments in juxtaposition

on the same level, the partition walls being lower that the sides, each tank or compartnent being provided with a false bottom, a sludge escape-cock or valve below the false bottom, the latter being formed of two planes inclined upwardly towards one another and having an opening at their apex, the opening being provided with an automatically closing flap and the planes being provided at or near their lower edges with small holes, the total area of which is less than the area of the sludge escape-cock or valve.

A Street Sweeper. 491,555. Hale E. Hawk, Alliance, O. This invention comprises a framework having vertical guides, upper and lower sprockets, broom-carrying belts mounted on the sprockets and means for operating the sprockets, and an axle, boxes for the same mounted in the guides, wheels mounted on the axle, a lever pivoted to the frame and provided with a locking means, a bell-crank mounted in the frame, a link connecting the same with the boxes and a connecting rod between the bell-crank lever and the first mentioned lever.

V. H. Lockwood, Patent Att'y.
Indianapolis, Feb. 20.

PIPE LAYING IN THE RIVER MAAS.

Something novel in water pipes is being laid across the river Maas at Rotterdam, Holland. The distance is about 3,000 feet, and the laying of a rigid pipe under the conditions involved was almost an impossibility. Therefore, a flexible tube was constructed, composed of short pieces connected with ball joints. Each pipe is 23.5 inches in diameter and 0.4 inches thick, made of mild steel and provided with steel flanges. The ball unions are cast-iron; outside diameter, 1,350 mm., or 4.5 feet; weight, about 2,300 kilos, or 2.26 tons. To sink the tube two barges are fastened together, and between them is constructed a wooden inclined platform of about 120 feet in length, and one end of which hangs in the furrow made in the bottom of the river to receive the pipes. The tube is built up on that platform, one end of the pipe being made fast on the bank. Afterward the barges are pulled back so far that there is room enough on the platform to put on another length of pipe with its ball joint, and so on. The length of one pipe with union is about 29.5 feet. The depth of the river is about 36 feet. The work has progressed rapidly each day, about 85 feet being laid.

ESTIMATES FOR PUBLIC WORK IN CHICAGO.

The public works department of Chicago, Ill., asks for $5,969,135 for use in the coming year. Of this amount $1,845,637 is appropriated for streets, with $887,442 of this to be expended for street cleaning.

Bridge construction calls for $1,014,447; sewer construction and maintenance, $308,320; Chicago harbor, $262,100; new pumps at the canal pumping works, $105,000. The street cleaning estimate is based on a cost of $22.50 per mile for sweeping and cleaning 3,437 miles of improved streets for nine months, making a total of 30,933 miles. For cleaning 26 times a year 193 miles of macadam streets, a total of 5,618 miles, the estimated cost is $25 per mile for the total mileage.

MUNICIPAL CONTROL OF FRANCHISES.

There seems to be a rapid growth of sentiment throughout the country in favor of municipal ownership of electric light plants. In Kansas City, Mo., the question is being agitated very vigorously by the press in favor of the idea, as far as that city is concerned, and in many other places and in various states the same subject is receiving popular consideration.

GOOD HEALTH OF SEWER WORKMEN.

Paris employs about eight hundred men to keep her sewers in repair, and these spend almost every day of the year under ground. Dr. Richardson, an English physician, who has investigated the matter, states that these men are as healthy as the average person, and no other eight hundred men in that city are so free from zymotic diseases as they.

NEW YORK CITY'S WATER SUPPLY.

The daily water supply of New York City now amounts to 171,000,000 gallons, as against 116,000,000 gallons, the daily supply prior to the completion of the new aqueduct. The full capacity of this aqueduct is over 400,000,000 gallons daily, but there is not yet sufficient storage capacity to provide this quantity.

PERSONALS.

Mr. George Bowers has been appointed city engineer of Lowell, Mass.

Mr. George S. Webster has been appointed chief of the bureau of surveys of Philadelphia. He has been connected with the bureau of surveys for sixteen years.

Gen. James C. Duane has been re-elected president of the aqueduct commission, New York City.

Mr. G. M. Eldridge has been reappointed city engineer and superintendent of water-works of Americus, Ga.

Mr. Samuel M. Gray of Providence, R. I., is making plans etc., for a sewerage system for Meridian, Miss.

W. H. Patterson and A. E. Demange are at the head of a project to construct an electric railway between Peoria and Pekin, Ill.

Mr. O. Wolff, C. E., of Copenhagen, Denmark, is visiting this country to investigate the various sewerage and water-works systems.

Mr. James K. Wilkes, city engineer of Willimantic, Conn., has resigned to take charge of the construction of a sewerage system at New Rochelle, N. Y.

Mr. Dion Geraldine, formerly superintendent of construction of the World's Columbian Exposition, has been appointed city engineer of Chicago in the place of Mr. L. H. Clarke, resigned. Mr. Bernhard Feind has been engaged as consulting engineer for that city.

The following officers have been elected by the Engineers' Club of Philadelphia: President, John Birkinbine; vice-president, James Christie; treasurer, T. Carpenter Smith; secretary, L. F. Rondinella; directors, Henry J. Hartley, John L. Gill, Jr., and W. B. Riegner.

At the tenth annual meeting of the Civil Engineers' Society of St. Paul, the following officers were elected: President, Geo. L. Wilson; vice-president, J. D. E. Slabrook; secretary, C. L. Annan; treasurer, A. O. Powell; librarian,

A. Munster; representative on the board of managers of the Association of Engineering Societies, C. J. A. Morris.

The officers of the Engineers' Club of Minneapolis, for the ensuing year, are: President, F. W. Cappelen; vice-president, John M. Hazen; secretary and treasurer, Elbert Nexsen; librarian, A. B. Coe; board of managers of Association of Engineering Societies, W. A. Pike.

At the thirteenth annual meeting of the Engineers' Society, of Western Pennsylvania, the following officers were elected: President, Max J. Becker; vice-president, Thomas H. Johnson; directors, Walter E. Koch and Emil Swensson; treasurer, A. E. Frost; secretary, R. N. Clark.

The following have been elected officers of the Montana Society of Civil Engineers: President, W. A. Haven, of Helena; vice-presidents, J. S. Keerl, of Helena, and Prof. A. M. Ryon, of Deer Lodge; secretary, G. O. Foss, of Helena; treasurer, A. S. Hovey, of Helena; trustee for three years, F. McRae, of Helena.

The Columbian Engineering Society of Washington, D. C., has elected the following officers; President, Francis R. Fava, Jr.; vice-president, W. G. Steward; secretary, F. W. Hart; assistant secretary, J. S. Pendleton; financial secretary, C. C. Jones; librarian, W. H. Aspinwall; additional members of board of directors. F. L. Averill; F. G. Perry and J. Meigs, Jr.

LETTERS FOR THE PUBLIC.

HINDRANCES TO EFFICIENT PUBLIC WORK.

To the Editor of Paving and Municipal Engineering:

SIR—One of the serious drawbacks to building good streets is the amount of "red tape" involved and political influence in selecting inspectors—the former in the nature of boards or councils, then the engineer and inspector. Although the specifications are as strict on the contractor as it is possible to make them, yet it is necessary to have all these officials to see they are properly carried out. Here is where the first "rub" occurs. They all have different opinions founded mostly on theory. The inspector is a man who gets his position through influence, not because he is capable of serving in this capacity, but because he thinks it is a "snap." And if he finds no real cause to "kick," why then he "kicks" on general principles, just to make the property owners think the contractor is robbing them, and he doing his best to keep him from it. Then the "chronic kicker" takes it up. He is ubiquitous; you find him everywhere. Generally he is not a property owner on the street in question, but a provident nature has made him to look after other people's business and see they are not imposed upon. Then the daily papers take it up; they put the contractor on a spit, turn him over and roast him to their own satisfaction.

What are the other two parties doing? As the board or council

know about as much concerning the matter in hand as the others, they generally side with them and to give dignity to their office lend their voice to the uproar. And the engineer, the only real knowing one, has to keep still and look on. If he wishes to do something, it has to have the sanction of the board or council, so practically his hands are tied.

How about the contractor? He is disgusted by this time and edges out the best he can. While they wrangle over trifles, he slights important matters and comes out ahead in the end.

How can this be obviated? By giving the engineer full control. Let him choose his assistants, and make him give sufficient bond to impel him to fill his office conscientiously. Make the contractor guarantee his work for specified time, and give bond for the same. And do not regard him as only little better than a common thief, but let him think the public considers him a man with just a particle of honor left, and that he takes some pride in doing his work in a manner that will be satisfactory to the public and a credit to himself. Nine out of ten will do it about right, for on their reputation depends their future work. No man can serve more than one master without discord, and a contractor is no exception.

The above has brick streets in view, and cities where they are being introduced as a new thing.

And such is the case as I have seen it. *F. W. Cerny.*

Columbus, O., Feb. 8, 1893.

NATURAL ROCK ASPHALT *VS.* TRINIDAD PITCH COMPOUNDS.

To the Editor of Paving and Municipal Engineering:

SIR — There is a paradoxical French proverb which says that "some dead men must be killed over again."

I just arrived here from Paris, en route for Chicago's World's Fair. I read in your issue of this month (what clear type, what excellent paper) another letter from M. Julius Schubert, repeating some of his old calumnies and blunders, and must, therefore, reaffirm that your honorable townsman, Mr. Gibson, did not receive information from me in order that he might disparage "American products," or laud French asphalt.

How Mr. Gibson obtained his information concerning asphalt roadways in France I do not know, but Americans are always well received in Paris and details readily obtained from the courteous town officials, as shown by the interesting report of Major Howard in your last issue. I am not the man to pay writers to attack American competitors, particularly after receiving their kindness and hospitality. So let Mr. Schubert prove his statements or withdraw them.

The roadway laid in Paris under Mr. Schubert's management was not "American asphalt," but a compound of Trinidad pitch (a British product), on French sand and powdered limestone—it broke up as Mr. S. owns.

The natural asphalt laid by me, in continuation of the above failure, is there to-day, Rue de Rivoli, between the Rues des Archives and Renard.

Mr. Schubert, as he truly says, has much to learn about asphalt, beginning at its name. One thing is that four lines of rails in a roadway increase the cost of maintenance thereof—there are then ten joints instead of two. I did not refuse the job; in fact am bound by my contract to the last, as ordered,

but I did ask for extra maintenance. However, Mr. Schubert rushed in where I feared to tread, and had a fall.

I have just finished a little book on asphalt. As soon as it is printed I will send you a copy for your correspondent; it contains a few facts which may be useful to him in case he be entrusted with another Rue de Rivoli job. The figures given of natural asphalt surface in Berlin, Paris and London are official. My company, as originator of the compressed asphalt industry, supplied the workmen and tools, and continue to supply the rock.

W. H. Delano.

Paris, Feb. 15, 1893.

QUESTIONS AS TO GRADES OF STREETS.

To the Editor of Paving and Municipal Engineering:

SIR—Something might be said as to the best mode of establishing the grade at the corner of blocks where the streets meet at right angles; also, where they meet obliquely. In side-hill towns or cities where the grade rises and falls from 0 to 15 per cent. the proper elevations at the corner of blocks is not so easily determined—property-holders all complaining at the same time. Again, where the street sidles, how far will the crown, camber, vertex or summit be from either curb, so that the grade on either side of summit will be the same? Also, how determine the elevation of points in the arc of a circle from the crown to the curb?

EXAMPLE WHERE STREET SIDLES 0.6 FROM B TO D TO FIND SUMMIT S.

Let $A\ B = a = 0.6$.
Let $B\ C = b = 42' =$ width of paving.
Let $C\ D = c = 0.6' =$ rise between curbs.
Let $D\ E = d = 0.6 = S$.
Let $S =$ summit on level with top of curb E.
Let $B\ F = S$ above gutter at $B = 1.2 +$
Let $x =$ the required distance $E\ S$.
Now, $c + 2d : b :: d : x$.

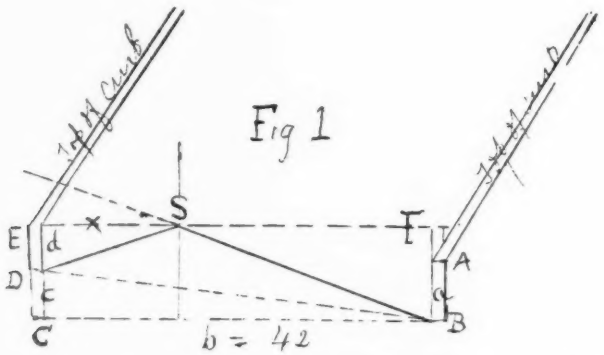
Therefore, $x = \dfrac{b\,d}{c + 2d} = \dfrac{42' + 0.60}{1.8} = 14$ ft.

from nearest curb; *i. e.*, the descent from S to B = descent from S to D.

Or, $\dfrac{b\ (c + d)}{c + 2d} = 42 - x = 28$ ft.

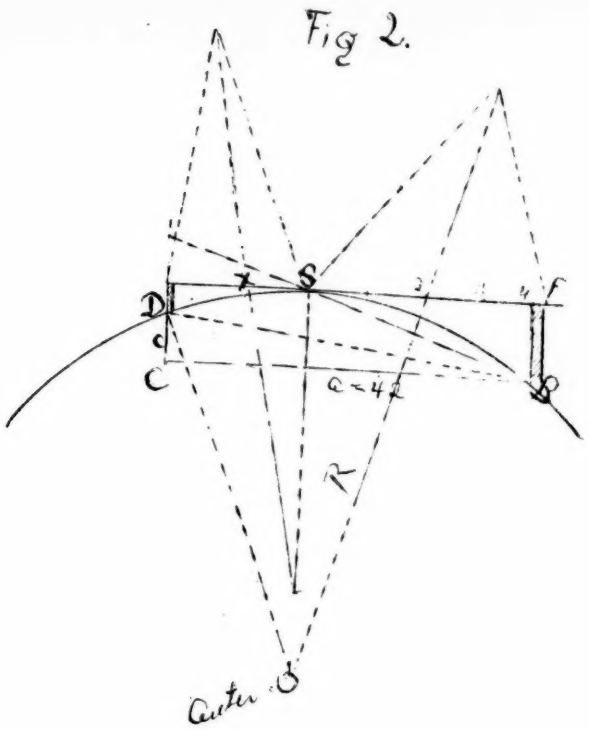
TO FIND THE RADIUS R THAT SHALL PASS THROUGH THE SUMMIT S AND THE GUTTER POINTS D AND B.

$$R = \frac{(S\,F)^2 + (B\,F)^2}{2\,B\,F} = \frac{(42 - x)^2 + (c+d)^2}{2\,(c + d)} = \frac{28^2 + 1.2^2}{2 + 1.2} = 327.27.$$ See notation, Fig. 1.



TO FIND DEPTH BELOW S AT EQUAL POINTS 1, 2, 3 AND 4 ON CURVE $S\ B$.

$\dfrac{B\,F}{4^2} = \dfrac{1.2}{16} = .075 \times 1^2 = .075 =$ depth below S at 1
$.076 \times 2^2 = .300 =$ depth below S at 2
$.075 \times 3^2 = .675 =$ depth below S at 3
$.074 \times 4^2 = 1.2 =$ depth below S at 4



In other words, the offsets practically increase as the square of the distance from *S*.

F. R. Lockling.

Hannibal, Mo., Jan. 16, 1893.

A PAVING EXPERIMENT OF ARMY OFFICERS IN WYOMING.

To the Editor of Paving and Municipal Engineering:

SIR—I am much pleased with the new garb and contents of the January number of your excellent periodical. I have watched with intense interest the unprecedented growth of your magazine from its inception. The reason of its phenomenal growth, aside from the enterprise and thoroughness of its management, is the long felt want on the part of municipal and other governmental bodies for special journalism in this direction. How is one to learn without a teacher? Ignorance may be bliss under some circumstances, but ordinarily it costs its possessor very dearly, and the mission of your journal is to enlighten and instruct, and suggest those practical lessons in municipal construction, drawn from the rich experience of the few, that shall save the individual and the community many a "pound foolish," by the expenditure of a few wise pounds, and that too with added comfort and luxury of living.

A copy of your monthly publication could fittingly be placed in the hands of every constructing quartermaster in the United States Army, and it would conduce to a better knowledge in matters of post sanitation—*e. g.*, sewerage and water conduction, etc., if a limited number of copies were provided by the Surgeon-General's office for circulation with other circulating period-

icals to the sanitary officers of the army—its medical corps.

I have placed your attractive January number on the post library table for the perusal of my colleague and the enlisted men of this garrison.

Apropos of the subject of paving material, let me mention a curious natural phenomenon that exists in the vicinity of this post, namely, an inexhaustible reservoir of liquid tar that continually bubbles up to the surface and by its quality of hardening on exposure to the air, has formed for itself a crater-like opening sixteen or eighteen rods in circumference, containing a pool of this liquid tar mingled with petroleum. When stirred with a stick by the wary adventurer, the pool exhibits beautiful irridescences, showing all the colors of the rainbow.

The rocks in this section of Wyoming show no evidences of vegetable remains, but contain many shells of shell-fish and vestiges of other salt water denizens, which makes it all the more strange and curious that this perennial fountain of liquid vegetable product should exist among us, like a veritable geyser, except that the flow is continuous and non-eruptive. Owing to the prodigality of nature in this region of Wyoming in the two paving materials of "tar and sand," the post quartermaster has constructed an inexpensive pavement across our parade ground out of this liquid tar mixed with fine gravel, and this walk exhibits many good qualities.

This tar spring is situated at present on an Indian reservation and is remote from a railroad, but when the reservation shall be thrown open to settlers and good facilities for transportation afforded, this liquid tar will find its way into commerce, and may yet make many a rough and crooked road straight and smooth and the weary, foot-sore traveler forget his woes.

I take pleasure in sending to your office a specimen of this liquid tar hardened by exposure to the air. *Henry I. Raymond,*
Assistant-Sur. U. S. Army.
Ft. Washakie, Wyo., Feb. 15, '93.

CONSTRUCTION OF PAVEMENTS ALONG "T" RAILS.

To the Editor of Paving and Municipal Engineering:

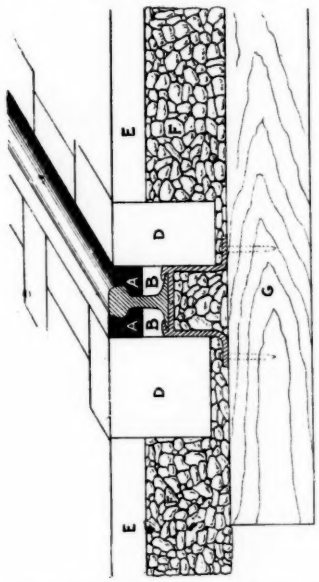
SIR—We beg to call your attention to a method of constructing pavements along the rails of street railroads, when the "T" rail is used, which, we believe, overcomes the objections usually made to that style of rail, on accunt of the dangerous spaces usually left between the rails and the pavement.

The method consists of filling these spaces with a composition prepared from genuine Trinidad asphalt, which composition when in a melted condition, is poured into the spaces and thoroughly tamped into place. Street railroad companies generally seem to prefer the "T" rail, on account of its stiffness as well as cheapness, but municipal authorities and the public almost universally object to its use, as the track is ordinarily constructed, on account of its obstruction to the wheels of vehicles. The adoption of the construction here proposed will, we believe, effectually remove these objections to the use of the "T" rail in the street railroad construction, as will be shown by the accompanying cut and explanatory statement.

Railroad tracks, constructed in this way, offer as little obstruction

or danger to vehicles as the girder or any other rail, except, perhaps, what is known as the English or grooved rail.

In the summer of 1891, the



A A. Special Trinidad Asphalt composition, poured and tamped around the rails.

B B. Hydraulic cement grout poured around the rails to within 2½ inches of the top.

C. Iron chair; but this may be substituted by wooden stringer if preferred, provided the stringer is not so wide as to make the space between the rails and the stone paving blocks over 1¾ inches.

D D. Single rows of stone paving blocks. The rows outside the rails being laid as alternate headers and stretchers, and the inside rows as stretchers, thick and thin blocks alternating, and laid ½ inch below the rails to allow for the flanges of the car wheels.

E E. Asphalt pavement, with grade falling slightly to the curb on the outside of the rails and crowning slightly to the center between the rails. This construction is adapted to any other form of pavement as well as asphalt.

F F. Concrete foundation of pavement.

G. Wooden tie.

Warren-Scharf Asphalt Paving Company had contracts for paving Columbia street, Utica, New York, and Main street, Amsterdam, New York. In both cases the street railroad companies desired to use the "T" rail, but, as usual, the use of that rail was strongly objected to by property-owners and city officials, on account of the danger to vehicles. At our suggestion, the construction herein described was adopted and resulted in general satisfaction to all parties interested and the method seems to be an entire success.

Portland Cement mortar and concrete have been used for filling these spaces, but have not proved successful because the material lacks the essential qualities of elasticity and malleability.

Having learned from our practical experience, the best composition for filling the spaces between the pavement and the rail, which, as ordinarily constructed, are objectionable, we have decided to prepare and offer it for sale to street railroad companies.

Warren-Scharf Asphalt Paving Co.
Utica, N. Y., Feb. 1, 1893.

ENGINEERING WORK IN PLAINFIELD, N. J.

To the Editor of Paving and Municipal Engineering:

SIR — PAVING AND MUNICIPAL ENGINEERING is just such a magazine as I have been looking for, for years, and have often wondered why some one did not step in and fill "this long-felt want."

I am by education a civil engineer, and for three years past have been street commissioner of this city. We have a complete system of grade maps for all the streets opened at the time the maps were made, viz., twenty-three years ago. These had been ignored for nearly twenty years; the result, water standing in the gutters everywhere. This has been remedied to a great

extent in the past three years, but not without incurring a good deal of opposition, as people here in the East are, on principle, opposed to anything like change; yet, now that those changes have been made, they are forced to admit that they have really been benefited by them.

Wishing you all the success that you so richly deserve in your enterprise, I am, *Robt. H. Meeker.*

Plainfield, N. J., Jan. 13.

SELECTIONS FROM THE PRESS.

T RAIL PAVING.

Many arguments have recently been presented for and against the T rail, as used in paved streets. It is a fact that some companies have paved to T rail in streets of considerable traffic, with fair results. If it were possible to devise a system of paving that would give as good a surface with a T rail as it is possible to obtain with a girder rail, the use of the T rail would probably be more prevalent for city lines. The great output of girder rail, however, tends to show that it is the best form for streets when heavy wagon traffic is considered.

Some of the cities in the south and west do not restrict the railway companies regarding the shape and weight of rails to be used on their lines, and the T form has been largely used in these portions of the country. In Atlanta, Ga., the Atlanta Consolidated Street Railway Company has good T rail paving, which was laid with great care by its chief engineer, H. Nimrod Hurt. The first step in laying this track is the preliminary excavation, which in this case is about fifteen inches deep. The ground is then well rolled, ties 6 by 8 inches by 7 feet, three-corners heart, yellow pine, are placed four feet apart, and securely tamped with the soil at hand, the dirt coming flush up to the top of each tie. On the ties runs an all-heart, yellow pine stringer, 5 by 6 inches. This stringer is spiked to the ties by steel knees or braces on every tie. The rail comes finally on the 5 by 6 inch stringer, spiked at intervals of three or four inches, and is forty pound T, Pennsylvania Steel Company's make. The paving used with this construction consists of Belgian blocks laid in four inches of sand. The Belgian blocks are laid flush with the stringer, and the space between the blocks and the rail is filled by two inches of concrete (sand and Portland cement) and two inches of asphalt. Immediately after laying the asphalt, and when it is still soft, a car is run over the finished track, and the flanges of the wheels cut a groove in the asphalt just large enough for the cars to operate nicely. A car must be kept at hand for this work while the paving is being done. When the asphalt hardens it serves as a tram to the T rail.

The extra care and material used in this construction bring the cost about up to that of a girder rail, forty-five pounds, with chairs, construction and Belgian block paving. The T rail paving, described above, has been in use six months, and is standing well. One defect is noticeable, however, and that is a flange of concrete and asphalt is

not as good as a flange of rolled steel. While this paving is doing quite well, it could hardly be recommended for use on a street of very heavy wagon traffic.—*Street Railway Journal.*

PAVING BRICK COMBINE IN OHIO.

That a "combine" or "trust" exists among the largest paving brick companies of Ohio has been demonstrated during the past season in making contracts for paving Zanesville streets. That some aggrieved property owners took the matter to court and were beaten in an attempt to defeat the alleged extortion is also well known, but they had little public sympathy, owing to the fact that most of them were acknowledged opponents of street improvement altogether where it affected their pocket-books. It was not so much the "highness" of the contract price. They were opposed to any paving whatever.

But the era of high prices for paving can not continue. The great profit in selling for $15 to $18 what it costs $5 to $8 to produce has led to a great many companies engaging in the manufacture of paving brick. The outlook is not favorable to a continuance of the present era of high prices. The competition is growing severe, and the "combine" is now only able to secure competitive contracts through rather questionable methods. That there was no great public indignation at the letting of the contracts in that city was probably due to the fact that the high prices were for home material, and the unpopularity of the chief "kickers," who were recognized opponents of all public improvements.

A gentleman, who is at the head of one of the largest paving companies of the state, in reviewing the situation to the *Clay Record*, in Columbus, said: "The present capacity of the various paving brick works of the country will pave over a mile per day, while the largest consumption the past season was less than half a mile per day. Thus you will see that a combine can not long exist. The end will certainly see the survival of the fittest. While it has been demonstrated that brick is the pavement for the future, the tendency of the manufacturers is to seek the best locations for good clay and cheap labor, and in this respect Zanesville is not likely to suffer. When it comes to the question of cheap production it will be impossible to haul both clay and coal to Columbus and compete, and we shall have to locate our factories elsewhere."

One of the best posted men locally on the brick question states to our representative that if the Zanesville paving contracts had not been let last fall, the same material could be purchased the coming season at a saving of at least 25 per cent., as the manufacturers are piling up stock and there is likely to be little demand for paving at the old price. —*Clay Record.*

SUPERIORITY OF VITRIFIED BRICK PAVEMENTS.

Vitrified brick is not considered as good material for street paving purposes by T. M. Symons as Trinidad asphalt. Probably no one will be surprised to hear that the gentleman recommends his own material. So far as he extols the merits of asphalt he may be given credit for the ability and earnestness of a promising salesman. For the pearls of wisdom relating to vitrified brick which he scatters so lavishly, we

fear there will be nothing but swine. The vitrifying process is comparatively modern. Many of the large cities of this country have never yet tested this pavement, but wherever it has been thoroughly tested, it is considered by the best authority as the pavement of the future. Its reputation is not sustained by tickling, itching palms with the spoils of a great monopoly. It is a public improvement that has come into use at the demand of the public, and its adoption in nearly every city has been solicited only after small blocks or crossings of streets have been laid by its enthusiastic advocates, and its vast superiority thus fully demonstrated. That is the kind of argument that is convincing. One doesn't have to obtain an exclusive contract for a whole street to demonstrate the superiority of vitrified brick. Wherever this material is used, great local industries spring up, so that street paving becomes a permanent home manufacturing enterprise, furnishing as much employment and conferring a greater public benefit than shops, factories or other industries that are often bonused. This material has especial recommendations here. Fine clay is found in this vicinity. It can be manufactured and laid down here cheaply. It is superior to all other pavements for a wet climate. It recommends itself to localities where the foundation is not absolutely permanent, in preference to asphalt, on account of the ease with which it can be repaired. For this reason also it is to be preferred in any growing and improving city where sewers and street car lines may be laid, or excavation rendered necessary at any time. Good vitrified brick forms a healthful, even, dustless, smooth, noiseless, and comparatively cheap pavement, and one that is more durable and easier to repair than any other suitable for the general traffic purposes.—*Pacific Builder.*

DECENTRALIZING EFFECT OF FIVE CENT FARES.

The system of five cent fares now in use on all street railways in the United States is causing a deal of quiet thinking in Europe, where this system is little used. In England, for instance, this system is almost unknown, fares being in proportion to the distance traveled. With people who are obliged to make every cent go as far as possible these differences in fares count for considerable, consequently in a large city like London the intramural systems tend to concentrate population as near the heart of the city as possible, because of the cost of surburban fares, while the one fare system has a tendency to decentralize population. In Chicago one fare will carry a passenger a block or an average of about eight miles in any direction from the heart of the city.

European and especially English thinkers are beginning to realize that here is an American idea that is well worth adopting. A somewhat modified system to this, called the Zone system, has already come into use on steam roads in some parts of Europe. But its application is more necessary to intramural traffic in order to relieve as much as possible the congested condition of the larger cities, and this system would not accomplish as much towards decentralizing population as would the straight one-fare-a-trip system. Very few modern improvements have so benefited the

cities of the United States as has the electric railway because of the facilities for rapid transit it has afforded. It has improved the health of the people by permitting them to live well out from the heart of the city, and it has made a man more self-reliant and a better citizen by permitting him to go well towards the outskirts of the city and build himself a home which his limited means could not have afforded but for rapid transit facilities and the low fare—for the electric railway could not have been the economic and commercial success it is had the one fare system not prevailed.—*Electrical Industries.*

PAVING BLOCKS FROM MAINE GRANITE QUARRIES.

Nearly all Rhode Islanders are well acquainted, through the press or personal visits, with the Westerly granite quarries. Should they visit those on the coast of Maine, they would find a great difference. The quarries here are mainly excavations in the ground, while those in Maine are simply a slow, but effectual, way of removing certain rocky hills. The Maine quarries are mostly in Carver's Harbor, Seal Harbor and Rockland. The largest plants are at the latter place. In hills of solid rock, with nothing but an occasional pine tree growing out of a cleft, the workmen drill numerous holes and blow out the blocks in any size they require. The blocks which are split into paving stones are generally cut about six feet long by three feet wide. The blocks that are bound for ports like Providence or New York are all transported by schooners. The wharves at which these schooners are docked are tapped by a tramway, on which runs a car with a drop-out bottom. Into this car a wagon load of paving stones is dumped. The car is then pushed along the tramway, which projects out over the vessel, and the bottom is dropped, and the blocks fall into the hold. In this way forty thousand blocks (a fair load for a small three-master) can be loaded in twenty-four hours. The price paid at the Maine quarries for the blocks ranges from $60 to $65 per thousand. Added to this must be the shipping rates, which are about $18 per thousand. Inclusive of labor and material, the cost of laying a square yard of paving on sand is $2.75, with concrete bottom from $4 to $4.25. The city has been so well served by the contractors that they have not only made good their agreement, but have furnished 300,000 blocks in addition. So far the city has laid this year 1,700,000 blocks, covering 80,000 square yards, and has about 100,000 now on hand.

Men who work in the Maine quarries make very fair pay, averaging $75 per month the year round. They work by the job, and the present rate at Rockland is $22.75 per thousand blocks. Once in a while some of the strikers at Westerly who own pieces of land on which they run dimunitive quarries all by themselves, have a few thousand blocks to sell. These are quickly bought up. — *Providence Bulletin.*

THE IMPROVED WELSBACH INCANDESCENT GAS LIGHT.

It will be in the recollection of our readers that considerable interest was aroused a few years ago by the introduction of the new system of incandescent gas lighting devised by Dr. Auer von Welsbach. The merits of the new light were duly appreciated, and it was employed

in a great number of establishments; but practical experience of its use revealed certain defects which militated against its very general adoption. The chief objection to the system was one which struck at its vital principle. The mantle of refractory material by which the light was produced was found to be too fragile, and its life too short, to enable consumers to realize the full economy claimed for it. These drawbacks were fully recognized by the inventor of the light and by those who were endeavoring to make it a commercial success; and they very prudently turned their attention to the removal of them. The result has been the production of a mantle which, as far as we have been able to learn, is much more satisfactory than any of its predecessors.

The improvements that have been effected in the system will be manifest from the following figures: When the Welsbach burner was first brought out, the light obtained from it with a consumption of 2.75 cubic feet of gas per hour was from 20 to 25 candles, or an average of 8 candles per cubic foot. Now, with the same quantity of gas a light of from 50 to 60 candles is produced, or an average of 19 candles per cubic foot. This improved lighting power is due to the changes introduced into the method of manufacturing the mantles; one of the principal ingredients with which they are impregnated being subjected to a delicate chemical process which heightens their luminosity. With regard to their durability—a very important point—great advance has been made in this respect. The mantles produced under the old process would not last more than 800 hours—that is to say, for doing really good work. After having been in use for this period, their efficiency decreased considerably. Those which are now being made have, we are informed, burnt for upwards of 3,000 hours with a loss of not more than 25 per cent.

This long life is not, however, claimed by the exploiters of the light (the Incandescent Gas Light Company, Limited) as general; 1,000 hours being estimated by them as the duration of the mantle for practical purposes. We learn that the improvements which have been effected in the Welsbach system have resulted in a marked extension of incandescent gas lighting in Austria, where it has received the serious attention of all interested in the supply of coal gas; and the result has been to counteract to a very large extent the adoption of electric lighting. In fact, several large installations of the latter system in Vienna have, we understand, been discarded in favor of incandescent gas lighting, with which nearly every establishment of any importance is now illuminated. It is only during the present year that the above-named company have been able to develop the improved Welsbach system in a practical form in England; but the success which has already attended their efforts in this direction shows unmistakably that the changes made have produced a light which is giving great satisfaction.

Of course, it is not for a moment proposed on behalf of the company—it would be useless to do so—to put forward the Welsbach incandescent burners in competition with the large gas lamps of the regenerative type which are now so largely and so effectively employed for shop as well as private lighting;

but, apart from these, it would, we think, be difficult to find in the market any system of gas lighting possessing the special qualities of economical and efficient illumination, combined with hygienic advantages, which are claimed for the Welsbach light as now manufactured.—*London Journal.*

COST OF OPERATING ELECTRIC STREET RAILWAYS.

What does it cost per car mile to operate electric lines? All the way from seven to twenty-one cents. We find in the west quite a number of lines on which trail cars are run that are operating for seven cents, others for ten, and one line where very long, heavy, single cars are operated for thirteen cents. These estimates include every expense except interest on the bonds. In some cases we are surprised to find that electric cars are operated more cheaply than cable cars under the same conditions. The pay of conductors and motormen ranges from fifteen to twenty cents per hour. One system pays twenty cents an hour for men; $1.50 a ton for slack coal, and shows a result of seven cents. Another pays seventeen cents an hour for help, $1.75 a ton for coal, or $2.60 per 100 lbs. for oil. On this railway the traffic is cared for by eight wheel cars, four wheel motor cars with trailers and the same style of car without trailers, and the annual report shows a cost of less than ten cents per car per mile. Such results must certainly stimulate the development of electric traction.—*Street Railway Journal.*

THE PAVING PROBLEM.

All pavements seem quite faulty at their best,
But some are not asphalty as the rest.

—*The Electric Spark.*

MACHINERY AND TRADE.

POPULAR FEATURES IN PAVING BRICK MACHINERY.

The frame of No. 1 Bucyrus Giant machine, manufactured by the Frey-Sheckler Co., of Bucyrus, O., is so substantially constructed as to render it as "break-proof" as it is possible to make it. The gearing is exceedingly heavy, housed throughout to reduce the noise accompanying common gearing. The concaves, or barrel of the machine, is neat in construction, as well as remarkably strong. The machine is supplied with first-class friction-clutch pulley, rendering the machine free from sudden starting.

The Automatic Cutting Table, manufactured by this company, is "a thing of beauty and a joy forever" to those using them. Each movable part is driven by absolutely positive gearing, rendering an imperfect cut impossible. So great has become the popularity of this table that the manufacturers find it impossible to meet the demand. They are now building an addition to their plant, after the completion of which they will be in condition to meet their continually increasing business.

Their repressing machines are giving much satisfaction. Fine mechanics are employed in constructing these machines. Each

part is "trued" and fitted to the machine before leaving the shops. The repress department of this company is kept running day and night to meet the demands of the trade. The brick are placed on the pickers, which convey them to the repressing boxes, where an upper and lower plunger grasps them and places a pressure of 95,000 pounds on each square inch of the brick. The brick are automatically ejected from the press boxes and delivered on an off-bearing belt to be taken care of by the "hackers."

The Dry and Wet Pans made by the Frey-Sheckler Company are made in three sizes—seven, eight, and nine-foot. They sold, during the year 1892, seventy-one (71) of their nine-foot drying pans, being the standard size. The seven- and eight-foot pans are exactly the same as the nine-foot pan in point of construction. The wet pans are made similar to the dry pans, except that they are provided with solid bottoms and discharge gates.

BRICK REPRESSING.

For securing the finest grades of ornamental and plain face brick, the process of repressing the brick is indispensable, and of late it is also coming into general use in the manufacture of paving brick. The advantages secured are greater uniformity in size, greater smoothness of surface, increased density and solidity, and the manufacturer can stamp his name and address or trade mark on each brick, which might prove a valuable advertisement to him. Moreover some popular patented forms of paving brick have to be repressed in order to secure the desired form and configuration. The introduction of power represses has made it possible to materially reduce the expense of repressing the brick, and also to increase the speed with which it could be done, for while with a hand press 3,000 brick is a good day's work, with a power repress 10,000 brick can be pressed daily, with the same force of hands, and with only one-half to one-horse power.

The Penfield Power Press above illustrated, combines beauty of design with unusual massiveness and strength. The pressure is exerted by a powerful toggle, arranged above the die where surplus clay

PENFIELD POWER BRICK PRESS.

from the die vents can not fall and interfere with the free action of the parts, nor does the die and die table have to be lifted each time a brick is pressed. The pressure is readily regulated, and is uniform and rigid on each brick, not being modified by or dependent on springs, which would cause objectionable lack of uniformity in the thickness of the brick.

The operation of the press is automatic. After the brick is placed in position on the feed table, it is automatically fed into the die, pressed, expelled from the die,

transferred to the off-bearing belt, and travels off on it. A clutch pulley is provided, placing the machine under immediate control, so that it can be started or stopped instantly. The machine has fewer parts than any other, is less complicated and easier to keep in perfect working order.

NOTES.

J. W. Penfield & Son, of Willoughby, Ohio, have issued artistic catalogues of their upright-stock brick machinery, and also of their auger brick machinery.

The Standard Dry Kiln Company, have issued a small pamphlet, giving much valuable information regarding their kiln and its uses for various purposes, together with testimonials of those who have had experience with it. The pamphlet also contains interesting information on the science of drying.

The thirty-first annual catalogue of the Frey-Sheckler Company, manufacturers of clay-working machinery, of Bucyrus, Ohio, is in print. It comprises 134 pages, is handsomely printed on fine paper, and is elaborately illustrated. The introduction states that over 4,300 brick machines manufactured by this company, are now in use in the United States at the close of 1892. The capacity of their machines used exclusively for the manufacture of structured street paving blocks was 2,560,000 daily. Over 1,940,000,000 standard paving blocks and building bricks were made on their machinery between April 1, 1892, and November 1, 1892.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Carthage, Mo., is discussing the subject of widening her narrow streets.

Nearly $2,000,000 has been expended in Topeka, Kan., for paving and sewerage.

The Twin City Paving Company has just completed an extensive line of granolithic pavements in Bristol, Va.

There is a project in Milwaukee to build a magnificent boulevard along the lake shore from Wisconsin street to the public park north of the city limits.

Wyatt M. Keedy, clerk of Hagerstown, Md., writes that that city is expending $60,000 in street and drainage improvements in addition to the regular allowance of $8,000 per annum.

E. O. Sellers, city engineer of Lansing, Mich., is figuring on two grades—Pennsylvania avenue, 1,364 lineal feet, and Kalamazoo street, 1,700 lineal feet. Some brick work will probably be done during the coming season.

Since the Supreme Court has decreed that councils of Philadelphia have the right to admit the trolley into that city, the various street car companies are vying with one another in offering to pave streets at their own expense for the privilege of running electric cars on them.

CONTEMPLATED WORK.

Arcola, Ill., is talking of street paving.

Atlantic, Iowa, talks of paving her main street.

Delta avenue, Cincinnati, Ohio, will probably be improved.

The council of Streator, Ill., ordered $150,000 worth of paving.

Quincy, Ill., will probably pave about one mile of street with brick this year.

A considerable amount of street paving is contemplated at Black Rock, N. Y.

Albion, Mich., is wrestling with the question of paving her main thoroughfare.

There is a move to improve Division street, Portland, Ore., from Eleventh to the city limits. The work will probably be done this year.

City Clerk John McCrimmon writes that Butte, Mont., contemplates paving some of her streets.

The Commercial Club of Muscatine, Ia., is agitating the question of street pavements for that city.

The proposed great driveway or boulevard around Salt Lake City, Utah, is being favorably discussed.

Asheville, Ohio, is making preparations for the brick paving of her streets during the coming summer.

Engineer Browne, of Richmond, Ind., writes that there will be some paving done in that city this summer.

Ashtabula, Ohio, will lay about 1,300,000 paving brick this season. The cost of paving Main street will be $30,000.

A. H. Tyler, city clerk of Parsons, Tex., says there will probably be some paving done in that city during the summer.

H. M. Cooper, of Cameron, Mo., writes that that city will do a considerable amount of street work next summer.

Roe street, Dayton, Ohio, will probably be paved with brick or asphalt. There will be about ten miles of street paved in Dayton this year.

The opening of Eighth street, Davenport, Iowa, from Harrison to Main, across the large ravine that exists between those streets, is being discussed.

John W. Willard, of Jamestown, N. Y., writes that the board of public works has recommended the paving with brick of about six miles of streets.

Ernest D. Martin, mayor of Marshall, Mo., says that the committees on street work have reported favorably for the macadamizing of Lafayette and Russell streets and paving with asphalt of Arrow street.

John Mawdsley, clerk of Adrian, Mich., reports that indications point to a considerable amount of paving work this year. A small amount of brick pavement has been laid; if it proves satisfactory, more will probably be contracted for.

A. S. Fisher, of Bedford, Pa., reports that a right of way ordinance has been granted to the Bedford Electric Railway Company. If the road is begun in the spring, said company will have a considerable amount of macadamizing or paving to do.

There is a movement for the paving with brick or asphalt of South Third street, Terre Haute, Ind., from Wabash avenue to Hulman street. The plan is to have eighteen-foot sidewalks, a double row of shade trees, with grass plots on each side of the walks. The roadway will be nearly ninety feet wide.

City Engineer Chapin, of Canton, Ohio, has estimated the approximate cost of improving North Market street from Lake street to the corporation line, by laying brick pavement 34 feet wide on a crushed stone foundation, at $19,417.50; also, Eighth street from Cherry to High, by laying a brick pavement 36 feet wide on a six inch foundation of concrete, at $21,917.50; also, Woodland avenue, from Lake to Aultman avenue, by grading, curbing and laying flagstone walks, at $7,237.50.

CONTRACTS TO BE LET.

Sandusky, Ohio, will put down five miles of asphalt paving in the spring.

The Springfield, Ill., city council has passed ordinances for the paving of several additional streets.

The Cleveland, Ohio, council has arranged to issue bonds for $521,000 for paving on twenty-one streets.

S. Rushing Ryno, city clerk of Rahway, N. J., writes that street macadamizing will be contracted for July 1st.

Engineer Chapin, of Canton, Ohio, writes that bids will be received on March 13th for grading Cedar street.

Bids will be received until March 6, for the paving of First street, from East Chester to Monroe street, Monroe, Mich.

New York City will repave thirty-eight streets with asphalt and twelve with granite blocks at an expense of about $1,200,000.

Proposals will be received until March 13th for the grading of Cedar street from Marion street to Harrison avenue, Canton, Ohio.

Bids will be received until March 11, for the construction of a street pavement on Main street, between Fair and Mulberry streets, Olney, Ill.

Engineer Henry W. Scott, of Seattle, Wash., says that a number of contracts will soon be let for street improvements to the extent of seventeen miles.

George F. Fullenwider, city clerk of El Dorado, Kan., writes that forty rods of stone sidewalk, four feet wide and four inches thick, two culverts, seventy feet long, and one hundred and twenty feet of three-foot sidewalk, will be built as soon as the weather will permit.

Bids will be received by Charles L. Kinney, city engineer of Elkhart, Ind., until March 8, for grading and paving a number of alleys with cobble-stones.

Bids will be received at the office of the Cincinnati Board of Administration until March 10, for brick driveway and other improvements in Eden Park.

W. E. Gillett, city clerk of Clyde, Ohio, reports that contracts are to be let for street paving and that $45,000 street improvement bonds are to be sold.

Galena street, from Ontario street to Summit avenue, Toledo, Ohio, will be paved with brick, and Lincoln avenue, from Monroe street to Waite avenue with asphalt.

Ordinances have been passed providing for improvement of parts of Monroe, Grand, Jefferson, Newark, Madison and Garden streets, and Park avenue, Hoboken, N. J.

Sealed proposals will be received at the office of the city clerk of Sandusky, Ohio, until noon, March 18, for the paving of Market street, from Jackson to Wayne, with fire brick.

C. F. Lane, clerk of Berea, Ohio, writes that bids will be received March 6 for brick pavement requiring about 720,000 brick, 10,387 cubic yards excavation and 6,440 linear feet stone curbing.

Olney, Ill., will pave Main street between the west line of Fair street and the east line of Mulberry street. Bids will be received until March 15 for the labor and material for constructing same.

M. M. Moore, city clerk of Columbus, Ga., says that bids will be invited for paving with granite blocks or Telford macadam, three squares of Broad street, about 2,200 square yards; bids to be in by April 5.

Sealed proposals will be received at the office of the Cincinnati, Ohio, Board of Administration until March 11, for the improvement with brick pavement, granite curbing, etc., of May street to the north line of Oak street.

J. W. Sedwick, city engineer of Pasadena, Cal., reports that contracts are to be let for cement sidewalk on Maungo avenue, and grade, gutter and curb on Palmetto street and Raymond and Los Robles avenues, about one and one-half miles of street.

The Mansfield, Ohio, city council has determined to proceed at once with the paving of Park avenue west. The roadway is to be made thirty-six feet wide from Main to Sturges avenue. Beyond Sherman avenue the improvements will probably be limited to the paving of sidewalks and gutters.

S. J. Smyth, city clerk of Tacoma, Wash., writes that Pacific avenue, from South Seventeenth street o South Twenty-fifth street, is to have a pavement, 100 feet in width, of bituminous rock on a six-inch concrete foundation. A wooden pavement will be laid this summer from South Seventh to South Seventeenth streets.

F. M. Shangle, clerk of Oscaloosa, Iowa, writes that sealed bids will be received up to March 3 for the grading, cement curbing and brick paving of High avenue, from A to F streets inclusive, requiring 10,444 square yards brick paving, 1,024 lineal feet brick curbing, 2,440 lineal feet cement curbing, and 5,812 cubic yards excavation.

CONTRACTS AWARDED.

J. E. Skelly, city clerk of LaSalle, Ill., writes that F. J. Sheehey has been awarded a paving contract.

The contract for paving East Main street, Greenville, Pa., has been awarded to Hallam & Sons, Washington, Pa.

Adna Dobson, city engineer of Lincoln, Neb., writes that about $125,000 worth of brick paving has been let for the season.

W. B. Wray, of Reidsville, N. C., reports that the contract for paving Scaly, Morehead and Gilmer streets has been awarded to Lea & Co.

Abner Genier, clerk of Delaware, Ohio, writes that he has been authorized to contract with the O. S. Kelly Company for one fifteen-ton steam road-roller.

W. K. Fox, city clerk of Plattsmouth, Neb., writes that contracts for paving two blocks with brick has been awarded to Charles S. Fanning, of Omaha.

The city of Franklin, Ind., has awarded the contract to build 6,438.5 square yards of brick paved streets, to the Acme Paving and Cement Company, of Indianapolis.

The Buffalo Paving Company has a $7,683 contract for paving with bituminous rock Glor street, twenty-eight feet wide, from Austin street to Military road, Black Rock, N. Y.

Contracts were let on February 23 for reconstruction and paving with brick Fourth street from York to Brighton, and Isabella street from Fourth to Ninth, Newport, Ky.

Henry W. Scott, assistant city engineer of Seattle, Wash., sends the following information: The contract for grading and sidewalking Moltke street, from Thomas to Morse, has been awarded to W. N. White for $10,066.90. The other bids were J. A. Bailey, $10,528.56; H. M. Byerly, $11,639.56; Charles Feek, $12,861.84; Taylor Bros, $11,401.58.

Samuel J. Mann, city engineer of New Albany, Ind., writes that Contractor J. J. Huncilman, of that city, has the contract for paving three blocks of Pearl street with vitrified brick on a six-inch foundation of concrete.

The Detroit, Mich., Board of Public Works has accepted Otto E. C. Guelich's bids on 54,000 square yards of Bermudez asphalt pavement on Woodward avenue. The same contractor laid last year 25,000 square yards on that avenue.

The contract for laying all vitrified brick sidewalks until July 1, 1893, to be laid in the city of Roanoke, Va., has been awarded to Wm. McCarty. Price for paving, outside of excavations, etc., is 71 cents per square yard. The cost is to be charged to the owners of the abutting property.

Engineer Wagoner, of Huntington, Ind., writes that Jonathan Sprinkler has the contract for building 564 lineal feet of six-foot brick sidewalk on Second and Wilkinson streets at 53 cents per lineal foot, with common burned brick on a foundation of six inches of broken stone and four inches of sand.

E. H. Reed, superintendent of streets, Cambridge, Mass., reports that the following bids were received for furnishing the city with 350,000 granite paving blocks for use the coming season: Rockport Granite Co, $61 per M; Austin Ford & Son, Cambridge, $60 per M; Quincy Paving and Edgestone Co., $44.90 per M; S. & R. J. Lombard, Charlestown, $39 per M. The contract was awarded to S. & R. J. Lombard.

J. C. Tompson, Jr., city clerk of Canton, Ill., reports that Davis & Dougherty, of Bellaire, Ohio, have been awarded the contract for paving in addition to the public square, about two miles of street with brick. The bid of this firm was 54 cents per foot for stone curbing, and $1.64 per yard for pavement. The entire work, grading, paving and curbing, will come anywhere between $88,679.17 and $96,244.42 according to the proportion of Canton brick utilized.

Charles L. Harrison, clerk of Bellevue, Campbell county, Ky., says that town has just finished the original construction of all her streets and alleys. The following awards have been made recently: Anton Walters, Gas alley, excavating 19 cents, flagging 25 cents, paving 70 cents; Printers' alley, excavating 19 cents, flagging 25 cents, paving 69 cents. Samuel H. Hays, Gould alley, excavating 20 cents, flagging 24 cents, paving 68 cents; Center street, excavating 20 cents, curbing 38 cents, paving 75 cents, gravel 75 cents, flagging 28 cents.

Robert Koehler, city clerk of Rock Island, Ill., sends the following information: The Edwards & Walsh Construction Company has been awarded the contract for brick paving work to be done next summer, at $106,642.42. The work will include 6,830 square yards paving at $1.27, and 3,320 feet curbing at 54 cents, on Eighteenth street; 39,684 square yards paving at $1.31, and 14,660 feet curbing at 54 cents on Fourth avenue and Twenty-fourth street; and 12,336 square yards paving at $1.61, 6,777 feet curbing at 55 cents, and 9,886 cubic yards filling at 35 cents on Twentieth street. In addition to this, the Street Railway Syndicate will have 6,821 square yards to pave at an estimated cost of $1.40 per square yard.

SEWERAGE.

Mexico, Mo., has just completed a $4,000 sewer.

Montgomery, Ala., will construct a sewerage system.

The general plan of the proposed sewer system in Rome, N. Y., has been framed.

A system of pipe sewers, total length 3,500 feet, will be put in at Richmond, Ind.

W. J. Scott, secretary of Denison, Tex., writes that the sewer extension to Red river has been completed.

E. O. Sellers, city engineer of Lansing, Mich., says that the average cost of pipe sewers during the past season was $5.14 per foot, including man-holes.

An effort is being made to secure a new system of sewerage for Hoboken, N. J. It is proposed to build a trunk sewer through Newark street with an outlet at the Meadows.

Work has been commenced on the new twenty-four inch sewer in Chestnut street, at Rockford, Ill. It will run from Main street to the river, and most of the work will be done by tunneling.

A score or more of main sewers have been recommended by the survey committee of councils, of Philadelphia, Pa., as needed improvements on which $3,000,000 can be spent to good advantage.

A duplicate set of all the sewerage system and record of sewers in the city of Chattanooga, Tenn., has been completed by Walter C. Pool. The set consists of forty-three sheets of tracing cloth.

L. E. Farnham, of Camden, N. J., writes that owing to the cholera scare not much paving and sewer work has been done there recently. The money has been expended in cleaning the city and filling up low places.

CONTEMPLATED WORK.

Middletown, Ohio, is agitating the sewerage question.

Lake Linden, Mich., is thinking of spending $15,000 on sewers.

Oklahoma, Okl., will have a system of sewers. The city will do the work.

S. Rushing Ryno, clerk of Rahway, N. J., writes that sewer work will probably be contracted for on July 1.

City Clerk Mawdsley, of Adrian, Mich., says a considerable amount of sewer work will probably be contracted for this year.

W. H. Poorman, city clerk of Livingston, Mont., says a sewerage system will probably be adopted and contract let in the spring.

John Sorenson, city clerk of North Platte, Neb., reports that the city is figuring on the probable cost of a sewerag system.

W. J. Miller, city clerk of Ann Arbor, Mich., writes that on March 20 the city will vote upon bonds of $30,000 for the purpose of building a main sewer.

W. F. Leete, clerk of Oneida, N. Y., writes that that village will vote on the adoption of a general system of sewers. If the vote is favorable, the system may be begun the coming summer.

W. H. Wilmot, city clerk of Lambertville, N. J., writes that that city is considering the matter of a sewerage system. A commission of prominent citizens has been appointed to look into the matter, and report to the common council.

The common council of the city of Toledo, Ohio, has decided that it is necessary to construct a cylindrical brick sewer, two feet inside diameter and four inches shell, along the center line of Front street, and alley west of Oak street, from sewer No. 211 in Front street to within twenty feet of Second street.

Estimates and plans for the construction of the Capitol Hill public sanitary sewer at Denver, Col., has been prepared and submitted by Engineer Meryweather. This plan calls for the building of a sewer to form an outlet for the Capitol Hill Sewer District No. 1, and will involve an outlay of $17,300.

CONTRACTS TO BE LET.

D. P. Pickard, secretary of Greenville, Pa., reports that contracts for terminal sewer will be let in the spring.

A twelve-inch pipe sewer will be built along Sixth avenue, Troy, N. Y., for which work contracts will soon be awarded.

Geo. R. Lash, city recorder of Pendleton, Ore., writes that bids will be wanted this spring for a sewerage system for that city.

Bids will be received by Charles L. Kinney, city engineer of Elkhart, Ind., until March 22, for the construction of various sewers.

The contract for laying a sewer in Washington street, between the bridge and Front street, Spokane, Wash., will soon be awarded.

J. W. James, of Sioux Falls, S. Dak., writes that bids will be received by Roy Williams, city auditor, up to March 6, for the construction of about 68,000 lineal feet of sewerage.

Bids will be received at the office of the city engineer of Bucyrus, Ohio, until March 7 for the construction of Prospect and Wiley street sewer in sub-main sewer district No. 14, and laterals Nos. 1 and 2 of main sewer district No. 4.

E. L. Shaw, city engineer of Marinette, Wis., writes, that a general sewer system has been designed for that city, and a large amount of work will be done during the coming season. Contracts will probably be let in April. The estimated cost of the entire system is $90,000.

CONTRACTS AWARDED.

The city of Monmouth, Ill., has contracted for six miles of sewers.

Kenosha, Wis., has awarded contracts for building 4,510 feet of 42 and 36 inch brick sewers, and 21, 18, 15, 12 and 8 inch pipe sewers.

The contract has been awarded for the construction of a sewer in Southgate street, from Isabella street to the Licking river at Newport, Ky.

Thomas F. Moore, of Buffalo, N. Y., was awarded the contract for building section six of the East side sewer district in consideration of $126,000.

L. E. Chapin, city engineer of Canton, O., writes that the contract for machinery for the sewage disposal works has been let to the Bonnot Co., of Canton, for $4,790.

Contracts have been let for the construction of sewers in the following named streets at Cleveland, Ohio: Champlain, between Ontario and Seneca streets; Chatham, between Ward and Jersey streets; Clinton, between Hanover and State streets; Hancock, between Jersey and Penn streets; Irving, between Pittsburg street and a point 400 feet south of Orange street; Jefferson, between University and Professor streets; McKinstry, between Literary and Railway streets; Myrtle court, Magnet street, Ocean street, Otis street, Princeton street and Wade avenue.

Charles G. Carlson, clerk of Moline, Ill., writes that Davis Co., of that city, has been awarded contracts for about 1,315 feet of ten-inch sewer on Eleventh street, from Twelfth avenue south to Sixteenth avenue, for $1,485; and about 1,665 feet of eight-inch sewer on Sixth avenue and Twenty-third street for $650.

The contract for the construction of a system of sewers in Hoosick Falls, N. Y., has been awarded to S. B. Sears & Emonson, Kingston, N. Y., at $32,628. The other bids were as follows: F. R. & L. W. Pratt, Albany, N. Y., $33,982; Muir Bros. & Nickleson, Port Huron, Mich., $35,575; Wm. H. Berry, Hoosick Falls, $35,623.20; P. H. Harrison & Sons, Newark, N. J., $37,428; Acock & Son, Trenton, N. J., $38,321; L. & L. E. Buckley, Hoosick Falls, N. Y., $40,952; Thos. McKeown, Buffalo, N. Y., $38,735.50; Evelin & Hall, Waterford, N. Y., $40,215; M. Sullivan, Little Falls, N. Y., $44,337; Michael Bennet, Utica, N. Y., $49,709; W. B. Connell, Youngstown, Ohio, $48,101; Daniel Murray, Port Chester, N. Y., $41,664; Frank L. Allen, Worcester, Mass., $55,357; Edmund Broderick & Co., Troy, N. Y., $51,170. J. Leland Fitzgerald is the designing engineer.

J. Arthur Stevenson, city clerk of Monmouth, Ill., sends a list of the bidders on the "Northwest Sewerage System," and their prices. The contract was awarded to the Monmouth Construction Co., of Monmouth, at $22,421 36. The other bidders were: J. D. Lynch & Co., Monmouth, $22,-777.88; Walker & Co., Kansas City, Mo., $29,537.89; Bick & Glann, Toledo, O., $28,-132.84; Andrew Anderson, St. Paul, Minn., $35,406.85; Cooper & Dorsey, Terre Haute, Ind., $24,586.31; Simons & Boyd, Quincy, Ill., $24,739.20; Tschirgi, Kringle & Deleney, Dubuque, Ia., $23,277 88. The system includes 1,040 feet thirty-inch two-ring brick, 1,133 feet twenty-four-inch, 1,907 feet eighteen-inch, 2,506 feet fifteen-inch, 20,011 feet twelve-inch, 3,611 feet ten-inch, 1,956 feet nine-inch, 200 feet eight-inch, and 2,500 feet six-inch pipe sewer, forty-five manholes and ten catch-basins.

John W. Willard, secretary Board of Public Works of Jamestown, N. Y., sends the following information: Arrangements have been made for the sale of $50,000—3½ per cent. thirty-year sewer bonds to parties represented by Chas. H. Wicks, of Jamestown, at a premium of 3¼ per cent. On February 4, bids were received on the construction of a certain portion of the main sewer and laterals of the complete separate sewer system lately adopted by the city as follows: Rider & Fitzgerald, Dunkirk, N. Y., $80,717.47; Kelly & Sheehan, Bradford, Pa., $79,748.70; John Hadley, Canton, Ohio, $70,496.87; W. B. Connell, Youngstown, Ohio, $63,642.40; Standard Construction Company, Pittsburgh,

Pa., $55,208.85; John O. Smith, Buffalo, N. Y., $52,070.90; Sloan & McElwain, Pittsburgh, Pa., $49,988.75; W. H. Roberts, Pittsburgh, Pa., $42,670.10. The contract was awarded to W. H. Roberts.

City Engineer Mann, of New Albany, Ind., writes that the contract for laying an eighteen-inch pipe sewer, 1,070 feet in length upon Spring and Pearl streets, has been awarded to J. J. Huncilman.

WATER-WORKS.

Athens, Ga., has contracted for new water-works.

Covington, Ind., will soon have a new water-works plant.

Niles, Mich., is negotiating for a $40,000 system of water-works.

Horton, Kan., is negotiating for a $40,000 system of water-works.

Water-works have been voted for at Fairmont, Ind. The plant will cost $30,000.

The city clerk of Atlanta, Ga., writes that that city is constructing magnificent new water-works.

Darius Hult, clerk of Rochester, Ind., writes that the city intends putting in water-works in a short time.

W. T. Dougherty, secretary of Oak Cliff, Tex., writes that the city expects to complete its water-works plant in the near future.

Water-works are to be built at Van Buren, Ark.; Burlington, N. C.; Crescent City, Fla.; Barnesville, Ga.; Hutto, Tex.; Bonham, Tex.; and Huntsville, Tex.

E. W. Harrington, city clerk of Crete, Neb., writes that the city has purchased the water-works property from the College Heights Reservoir Company for $35,000.

The special water committee appointed by the Providence, R. I., common council to consider the matter of purifying the water supply, advise the construction of a system of mechanical gravity filters, capable of filtering 15,000,000 gallons of water a day. The cost of this proposed system will be about $130,000, which will include suitable buildings for carrying on the work.

CONTEMPLATED WORK.

The citizens of Martinsville, Ind., have voted for water-works by a majority of 300.

N. G. Underwood, clerk of Elizabeth, N. J., says that water-works improvements are contemplated.

The water-works question is being discussed at Shullsburg, Ill.; Carbondale, Col.; Traer, Ia.; and Exeter, Mass.

CONTRACTS TO BE LET.

Hartington, Neb., is to have a $10,000 system of water-works, some time in the near future.

W. E. Gillette, clerk of Clyde, Ohio, writes, that contracts are to be let for water-works extension. Bonds for $7,000 for the purpose are to be sold.

W. H. Weaver, clerk of Watseka, Ill., writes, that the water-works mains of the city will be extended this spring. The water tower was finished last October.

Adolph Anderson, city recorder of Logan, Utah, reports that specifications are being drafted for the balance of the new water-works system, and bids will be called for.

The Mason City, Ia., council have ordered water mains put in on Adams street, from Seventh south to State; also on Main street to Ninth, and west on Ninth street.

J. E. Skelly, city clerk of La Salle, Ill., writes, that the city expects to lay a considerable amount of iron pipes for water-works. Contracts will probably be let for small quantities.

CONTRACTS AWARDED.

Yonkers, N. Y., has contracted for water-works with the New York City District Water Supply Company.

Contracts for new engines and boilers for a new pumping plant in Brooklyn, N. Y., have been awarded at $306,900.

The contract has been awarded for the construction of a water-works plant in Greenville, Ohio, to cost $79,130.38.

J. B. Carter, city clerk of Shenandoah, Ia., writes that a contract for twenty-eight hydrants and four gate valves has been awarded to the Ludlow Valve Mfg. Co., Troy, N. Y., for $675, about $100 higher than the lowest bidder.

The contract for foundation for stand-pipe and erection of power house has been awarded to Jacob Koons for $2,370. Contract for stand-pipe has been let to Riter & Conley, of Pittsburgh, Pa., and water-pipes to the Chattanooga Pipe Co.

Stevens & Bedwards, of Logansport, Ind., have been awarded the contract for putting in the water-works at Edinburg, Ind., at $16,751. The amount of pipe bid on was 3,800 feet of eight-inch pipe, 1,200 feet of six-inch pipe, 3,900 feet of four-inch pipe, and fifteen hydrants.

Seth Smith, town clerk of Provincetown, Mass., reports that the contract for laying water-pipes, etc., has been awarded to Lucian A. Taylor at $7,997.62. There were thirteen other bids, ranging in price from $8,360.68 to $13,347.20. The contract for furnishing pipe was let to McNeal Foundry Co., Burlington, N. J., for $18.500; for hydrants, to the Chapman Valve Manufacturing Co., Boston, at $1,412.17; for valves to the Rensselaer Manufacturing Co., Troy, N. Y., at $1,338.60.

BRIDGES.

Contracts for bridges will soon be let in Knoxville, Tenn.

A $60,000 bridge will be built across the river at Winnepeg, Manitoba.

Hunt county, Tex., is to have four iron bridges at a cost of $1,425 each.

A new iron bridge is soon to be built across the Republican river at Guide Rock, Neb.

Bids will be received till noon March 3 on a four-span steel bridge at Des Moines, Iowa.

The Grand Trunk Railroad will probably build a new bridge across the gorge at Niagara Falls.

There is a prospect that a big bridge will soon be built between Superior, Wis., and Duluth, Minn.

An iron bridge is to be built over the Sangamon river in Macon county, Ill. The contract has been let at $3,352.

The Kentucky Legislature has authorized the construction of another bridge between Cincinnati and Covington.

Bids will be received by the county commissioners of Plattsmouth, Neb., until March 9, for the construction of all bridges to be built by the county during 1893.

W.G. Underwood, city clerk of Elizabeth, N. J., writes that contract is to be let for an iron drawbridge over Charles creek, twenty-four foot span in the clear, sixteen foot roadway.

The award for the four track drawbridge to be built by the New York Central Railroad Company over the Harlem River, has been made to the King Bridge Company, of Cleveland, Ohio.

The board of public works of Indianapolis proposes to increase the lasting quality of the timbers in the Pogue's run bridge at Washington street, by having them chemically treated.

City Clerk Genier, of Delaware, O., writes that the bridge committee has been authorized to advertise for plans, specifications, etc., for a bridge across the Olentangy river on Central avenue.

The city of Petersburg is preparing to build a bridge over the Neva, to cost $14,000,000. The plans and specifications were drawn by M. Eiffel, the distinguished French architect and engineer.

The Montgomery Bridge Company has a bill in the assembly which has for its object the building of a bridge across the Alabama river, between Montgomery and Wetumpka. The company's capital stock will be $150,000.

Engineer L. P. Wolff has submitted drawings and figures for the proposed walking and driving bridge across the Mississippi at Red Wing, Minn. The bridge would be 2,000 feet long and 24 feet wide; the total cost is estimated at $70,000.

New York City and Jersey City people are about to build a railroad bridge across North river to be sixty feet high above the water. It will be 10,680 feet long, and the main grade will be at the rate of forty-five feet to the mile. It rises from low ground on the New York side.

The Atlanta, Ga., council invites plans, specifications, and bids, until April 1st, for the opening of Alabama street, by going over and bridging the Central Railroad tracks, and under the East Tennessee, Virginia and Georgia and the old Monroe tracks, to a point at, or near, Elliott street.

The Michigan Central Railway Company built a new iron bridge across the Kalamazoo river at Battle Creek. It was built parallel with the old one and put on rollers ready to be moved into place, and just six and a half minutes after the old bridge was cut away the new one occupied its place, so that not a train was delayed on account of the work.

The bill permitting the building of the bridge over the Mississippi at New Orleans has been signed by President Harrison. It will be the longest Cantilever bridge in America. The length of the main span will be 1,095 feet, and each end span 757 feet, resting eighty-five feet above the surface of the water, being of sufficient height to allow the largest river steamers to pass under it; the approaches will each be at least a mile long. It will be unequalled this side of the wonderful Firth bridge on the east coast of Scotland, which has three spans of 1,710 feet each. Its estimated cost is $5,000,000, and it is to be completed within three years..

Charles L. Harrison, clerk of Bellevue, Campbell county, Ky., writes that the new street car company, of which John J. Shipherd, of Cleveland, O., is president, intends building a viaduct for an electric road between Bellevue and Newport. An attempt was made to raise money by subscription for a twenty-thousand-dollar viaduct, but the plan was abandoned.

STREET LIGHTING.

The citizens of Gallipolis, O., have voted almost unanimously in favor of electric lights.

The price in Sweden of incandescent lights, with all voltages up to 125, is about twenty cents.

Three thousand gas street lamps in New York City will be replaced by 1,000 electric lights this year.

R. D. Mann, clerk of Swanton, Vt., writes that that village is negotiating for an electric light plant.

John Sorenson, city clerk of North Platte, Neb., says that city will probably have an electric light system in the spring.

F. B. Orser, clerk of Addison, N. Y., writes that a contract for street lighting by electricity has been let to F. H. Wheaton.

S. Rushing Ryno, city clerk of Rahway, N. J., writes that street and public building lighting will be contracted for July 1.

W. E. Gillet, clerk of Clyde, Ohio, reports that contract is to be let for an electric light plant. Bonds for $12,000 are to be sold for the purpose.

Thomas B. Dunn, city secretary of Corpus Christi, Texas, writes that the city's contract for street lighting expires in April and a new one will probably be made.

O. S. Norsman, city clerk of Madison, Wis., writes, that the contract for electric lighting has been awarded the "Capital City Electric Company" for three years. It calls for ninety twelve o'clock, 1,200 candle-power electric arc lights at $57 per lamp per year, and thirty-five all night lights at $87 per light per year. The other bidders were "Four Lakes Light and Power Company," of Madison; the Madison City Gas Light and Coke Company, for lighting by gas; and the Globe Light and Heat Company, of Chicago, for lighting by gas from naphtha.

Wyatt M. Keedy, city clerk of Hagerstown, Md., writes that he has been ordered to advertise for bids for electric street lighting. The present contract expires July 1.

L. E. Browne, city engineer of Richmond, Ind., says, that city is investigating the matter of street lighting with arc lamps, with the intention of securing more satisfactory light.

Ernest D. Martin, mayor of Marshall, Mo., writes that the election on February 14 resulted 789 to 71 in favor of electric lights. Franchise has been granted to Macon City Electric Light Co., of Macon, Mo., with a contract for three years for 25 arcs of 2,000 candle-power each, and 20 incandescent lamps of 32 candle-power each.

John W. Willard, secretary board of public works of Jamestown, N. Y., writes that the board has recommended to the council an addition to the electric light plant involving an expenditure of $15,000. The question will be voted upon by the city. The electric plant is under the control of the board of public works, being in direct charge of Robert Bryan, one of its members, who is furnishing the city with about one hundred and fifty 1,200 candle-power arc street lights at an average expense of less than four dollars per lamp per month.

M. M. Moore, clerk of the Columbus, Ga., council, writes that a contract has been let to the Brush Electric Light and Power Company for 102 arc electric street lights of 2,000 candle-power, at $120 each per year. There was no other bid excepting that of the Gas Light Company, proposing to furnish 400 to 600 gas lights at $15 each per year. The committee on street lights, of which H. H. Daniel is chairman, was instructed to investigate the cost of plant of 150 arc lights of 2,000 candle-power capacity with a view of having same ready by the first of January next.

PUBLIC PARKS.

The park commissioners of Waltham, Mass., are considering the expenditure of $40,000 or $50,000 in the purchase of lands for park purposes.

Mrs. S. S. Vaughn has donated a forty-acre park to Washburn, Wis. It is about 300 feet above the lake and has a gradual slope toward the bay, thus assuring perfect draining with very little expense, and what is more, gives one of the grandest and most beautiful views in the entire Northwest.

Estherville, Ia., is discussing the question of a public park.

Special street commissioners in New York have been making plans for a new street called Cathedral Parkway, which will unite Central Park, Morningside Park and Riverside Park in one continuous driveway. The road will be under the control of the Department of Parks, so that trucks and heavy teams will be excluded from it.

Minneapolis will establish a park at Sandy Lake. The plan provides for the purchase of 125 acres contiguous to the lake in question, at an average price of $1,096 per acre. The Minneapolis Improvement Company Northeast, puts in some of their land at nearly $1,000 an acre less than was paid for it, and in addition they will give out of their treasury for the immediate improvement of the park, $20,000, which will put it in very nice shape. The park board committee favors the enlargement of Powderhorn park.

STREET RAILWAYS.

Alexandria, Ind., will have an electric street railway.

Columbiana county, O., has fifteen miles of electric railway.

A franchise has been asked for an electric road at Northboro, Mass.

It is proposed to build an electric road to connect Trenton, N. J., with Newtown, Pa.

A street railway at Key West, Fla., proposes to relay the tracks and put the whole line in repair and equip the road with electricity.

The council of Argentine, Kan., has granted a franchise to the Union Terminal Company to lay tracks and operate its lines in that city.

R. W. Havens, city engineer of Dallas, Tex., writes that the city has granted a franchise for a new electric railway, which will be about eight miles in length.